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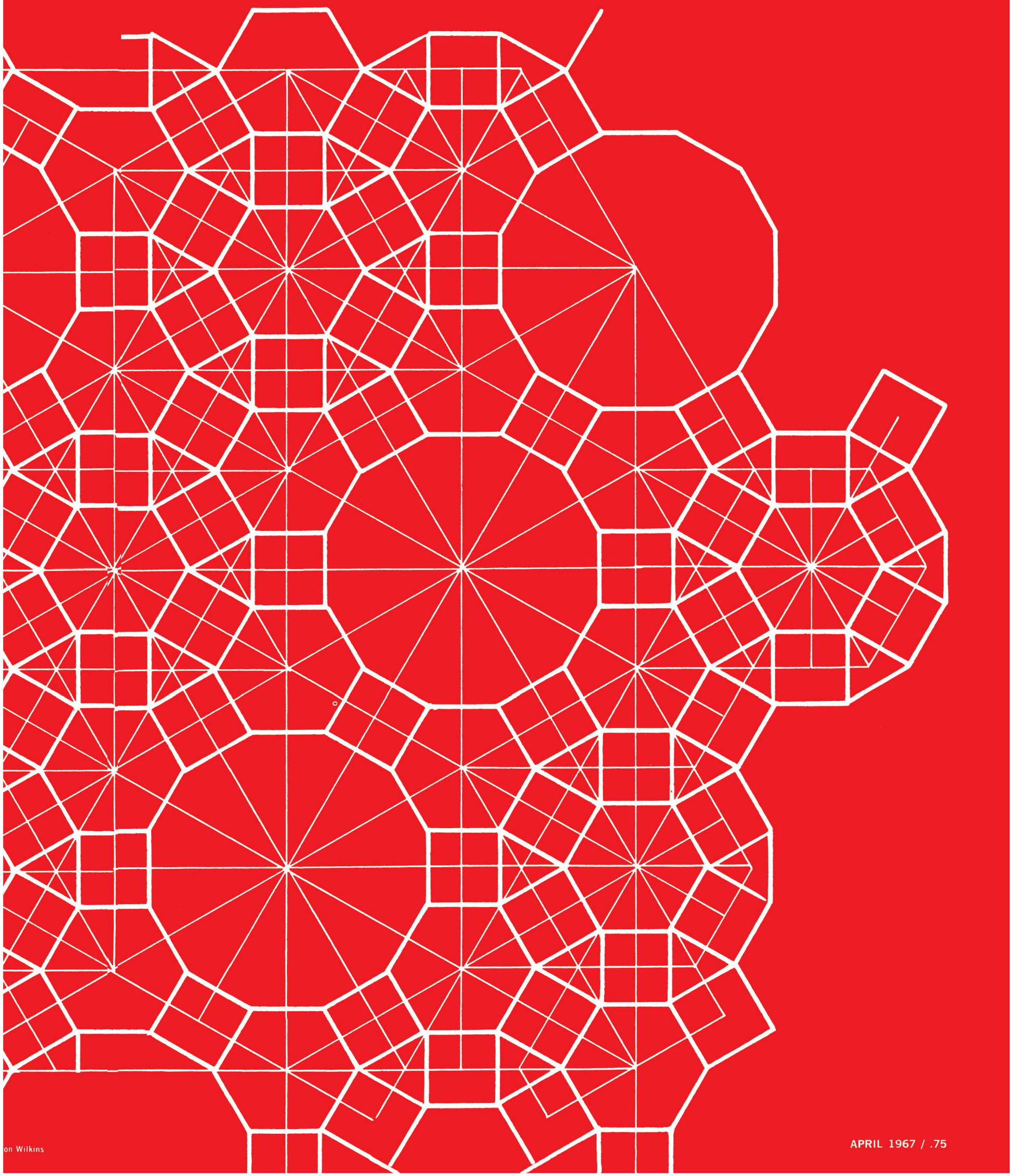

on Wilkins

APRIL 1967 / .75

order and disorder

International Design Conference in Aspen June 18-23

Max Bill, Swiss architect, artist, author and educator
Dr. Jacob Bronowski, Salk Institute scientist
Theo Crosby, London architect, author and city planner
Piet Hein, Danish poet, mathematician and scientist
Moshe Safdie, the architect who created Habitat 67
Jerzy Soltan, Polish architect and educator
Peter Ustinov, producer, playwright and actor
will meet in Aspen to discuss Order and Disorder

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Vol. 84, No. 4

art

DORE ASHTON

Angry Arts or Angry Artists?

There was an early Renaissance artist who signed his works "als ich kann," which I suppose would be translated "as well as I can." I've forgotten his name or even the reasons for the diffidence of his signature, but I thought of him often as I watched some of the more than forty events recently grouped under the title "Angry Arts Against the War in Vietnam." Out of the great anxiety the circumstance of this war has generated, the artists pulled material for this manifestation, each as well as he could.

No one would claim that there was signal artistic merit in any of the various performances or the works of visual art presented. On the contrary, the estrangement from narrative and allusive art, obvious in both the written and spoken arts, and the plastic arts, has made the expression of anger an awkward and exceedingly worrisome problem for the artist.

If anything emerged from this spontaneous chorus of anguished voices, the problem of communication is first on the list. Each artist who was driven to testify was confronted in one way or another with the 20th century Western tradition of pure artistic form on the one hand and the need to localize and specify the source of his anger on the other. This was true particularly of painters and sculptors who keenly felt a division of loyalty: loyalty to Art or loyalty to Ethics.

Some found temporary solutions by going outside their personal style just to be on record. A group of the coolest artists in town, for instance, organized a sort of a happening in which they blew horns, beat drums and sculptures and made a suggestive music of dissent. Others wrote their names large on the Collage of Indignation shown at N.Y.U.'s Loeb Center, but refrained from presenting an image. Still others resorted frankly to message communication, turning their skill to the production of clearly readable collages with photographs figuring large in the telling. Not one artist, to my mind, was able to work at the intense and undividedly passionate level which enabled a Goya to express the full measure of his pitiless rage.

I don't believe the kind of doubts and questions raised during the recent months among artists are peculiar to this moment. Such doubts linger in any serious artist's mind almost always. But their externalization in numerous conversations, symposia, and even obliquely in the work itself, is certainly germane to this particularly horrifying moment in history.

Before I go further, I'd like to point out that throughout the Angry Arts programs, the focus seemed always to fall on the children, victims of napalm and white phosphorous. Very rarely were there abstract or intellectualistic issues raised. Physical and moral horror of infanticide were the authentic sources of anger. And just beyond anger lies the unshakeable succubus, Guilt.

If this were the first 20th century moment of malaise, the lack of a working philosophy would be more understandable. But artists are all too well aware of previous crises and the blunders committed in the name of moral anger. One of the salient frustrations was precisely the absence of any formulated position. We have no Jean Paul Sartre who can write eloquently about an abstract artist and justify him as a political man (Lapoujade), nor do we have any native philosophers who can give form to the issues beyond a human reflex of revulsion in the face of criminal genocide. Most of the participating artists were working at this primary reflex level which is touching, but troubling also.

Perhaps only those who have been directly exposed are free to form a firm position. Europeans who lived the Second World War tend to be more adept at handling the issues. I think of the poet Benjamin Peret who died in 1959. All his adult life he had been in the ranks of the avant-garde, working along with Breton in the surrealist movement and writing superbly imaginative poetry. He was also a Marxist of some note, actively engaged in political activity, including the Civil War in Spain. Peret watched with growing anger the misguided efforts of fellow artists to accommodate their historic guilt by subverting their art, and during the Second World War, he wrote a stirring essay called "The Dishonor of Poets."

In it he defended his art against the false incursions of propaganda. He explained that the poet fights against all oppressions—of man by man first, and the oppression of his thought by religious, philosophical or social dogma.

Because a poet is peculiarly sensitive to injustice, he explained, it doesn't follow that he wants to put poetry in the service of political action. "But his quality as poet makes of him a revolutionary who must combat on all terrains: that of poetry by the means proper to it and, on the terrain of social action, without ever confusing the two fields of action."

The poet who writes propagandistic poetry, even if it is anti-fascist, is a reactionary, a publicity agent:

"Each 'poem' that exalts a 'liberty' willfully indefinite when it is not decorated with religious or nationalist attributes, ceases to be a poem in the first place, and constitutes an obstacle to the total liberation of man since it fools him by showing him a 'freedom' that conceals new chains. On the other hand, in each *authentic* poem a breath of total and active freedom escapes, even if this liberty is not evoked in its political or social aspect . . ."

Peret's clear distinction between social action and his art made it possible for him to act, as he says, on both terrains. But most of our artists are innocent of social action on a direct line, and so have nothing with which to shield their art. As their personal sense of guilt burns ever deeper, their means become more and more fragile. This, of course, is part of the legacy of modern art and of Western philosophy. One of the points Herbert Marcuse makes in condemning the one-dimensionality of our society is that we have long been seduced with the myth of individual salvation. In Germany, Martin Luther directed his souls to "inner value," and "diverted their claims and demands from the external world into their inner life. Luther established Christian liberty as an internal value to be realized independently of any and all external conditions."

Perhaps this emphasis on internal value explains the absence of strong dissenting voices among the older generation artists, those stars of the American ascendence in visual art who at one time so earnestly declaimed the doctrines of crisis and conscience. Many younger artists bitterly remarked the absence of Motherwell, Rothko, deKooning, Tworkov, Brooks and a host of others who at one time were such paragons of philosophic virtue and who are sternly silent today. (Only Ad Reinhardt keeps the faith, it seems, and a few Europeans such as Matta, Appel, and New Yorkers of European origin who worked on the Collage.) Perhaps for them "liberty as an internal value can be realized independently of any and all external conditions." For the younger men and women, the external conditions refuse to remain external.

One of those younger painters very active in artists' protest affairs is Leon Golub. Like others of his generation he is caught in the mesh of loyalties forged for more than half a century in the cause of modern art, and is forced to ruminate at this point by external circumstance.

Golub asks: What is is the meaning of a symbolically perfect and a physically faultless art? He immediately affirms that "we recognize the autonomy of modern art, that art is a privileged sanctuary and an instrument for pleasure and sensibility." But, he continues, modern art is more than that: "It has always represented freedom to the artist and a gate to the future. Such an art must be open to all manner of freedoms and represents at its best an ideal and platonic world, that is to say, a world whose hope of perfectibility is symbolized in its art."

America's claim to being a free society, he says, is cancelled by its brutality toward the underprivileged of the world. "When we destroy the Vietnamese people, the forms of our society and the perfect forms and abstractions of our art are *threatened*. Western

man's God-like self-privileged creative privacy is threatened. It is impossible to export fascism and destruction and maintain the dream of perfectibility of art."

Golub does not offer a formula for confronting contradiction, but he does express the new awareness and fright that has overtaken even the purest of modern artists. He speaks for a host of painters, sculptors, dancers, filmakers and poets who, despite considerable personal discomfort and troubling thoughts, brought themselves to collaborate in the chaotic Angry Arts affair.

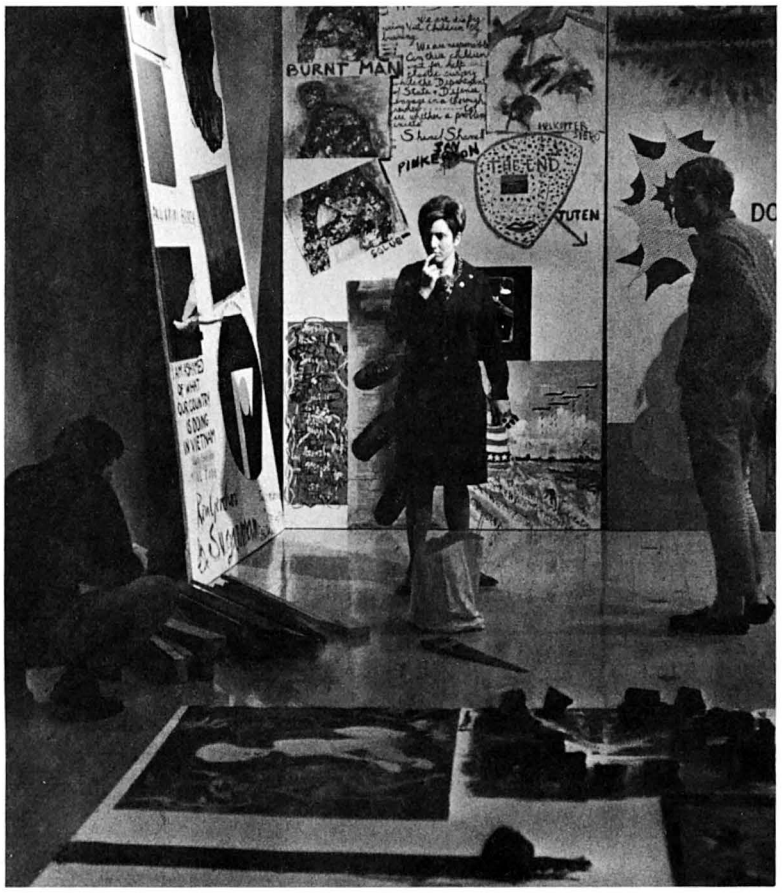
The fact is that few artists believe they can buck what Prof. Marcuse has called the "Happy Consciousness," the belief "that the real is rational and that the system delivers the good." Yet the war is upon us, and its pressures intolerably distracting. Each works as he can.

Unquestionably, certain media are mose adaptable than others. It is certainly easier for a mime troupe and a group of young poets to try to pierce the fabric of happy consciousness than it is for abstract painters or composers. The group that went out with a float adorned with a frank political caricature by painter Allen D'Arcangelo easily attracted audiences on the streets of New York and delivered its fervent message. At specific street corners (for which endless police permits were required) the truck parked and the solemn poets stood to read poems ranging from Milton's 1655 "On the Late Massacre in the Piedmont"—in which the poet calls upon the Lord to avenge slaughtered saints and punish those "who hurled mother and infant down the rocks"—to a 17th century Japanese poem by Basho about Vietnam and its previous troubles. People who gathered were generally either respectful or neutral, unlike the officials of St. Patrick's Cathedral who later took a harsh position when many of the same young poets brought their protest into the church.

At this writing, news of countrywide Angry Arts demonstrations and even an assault on Washington confirms the growing frustration and anguished search for a means to bring the artist's conscience into effective action. While I doubt that any fundamental problems will or can find solution, I believe the initiation of discourse will clear the air considerably. Each will work as he can to purge himself and, by association, his audience of the intolerable guilt attending this intolerable war.

Photos by Karl Bissinger

Contribution by Adja Yunkers to the Collage. Photo by Laurence B. Fink



Painter Stephen Green working on "Collage of Indignation for Angry Arts Against the War in Vietnam" at NYU Loeb Center.

books

THE NEW BRUTALISM by Reyner Banham (Reinhold, New York, $15)

Reyner Banham, the British architectural critic, has certainly emerged in the past 15 plus years as one of the major figures on the contemporary architectural scene. His earlier book *Theory and Design in the First Machine Age* is already one of the acknowledged classics of twentieth-century architectural writing. Like that of other influential writers such as Henry-Russell Hitchcock and Sigfried Giedion, Banham's writings assumes a high degree of importance because he is both an active participant as well as an outside observer. He not only views the immediate past in the role of architectural historian, but he is equally the propogandist who has consciously sought at one moment or another to direct the course of architecture.

Although not invented by Banham, the phrase New Brutalism has become so closely associated with his name that it is difficult to conceive of the one without reference to the other. Moreover his book on the subject is not at all a history of the Brutalist movement in the normal sense of the term. Rather it is an autobiographical reminiscence of the movement written by its most active apologist. It is then a primary document on one of the most important of the post-war movements—as important to our understanding of the architecture of the 1950s as the actual buildings which embodied the principles of the New Brutalism.

Although the phrase New Brutalism was, and to a lesser degree still is, bandied around among the coterie, the question remains as to how significant was the movement in the 1950s? That it was essentially a British phenomenon Banham admits, but he feels that it made and still is making a substantial contribution to world architecture. To quote the author, "It was, in short, the first consequential British contribution to the living body of architecture since the collapse of the 'English Free Building' of Voysey and Lethaby around 1910." (p. 134) There can be little dispute that the *philosophy* of the New Brutalism (with its closely related ethical and esthetic principles) does indeed constitute just such a major British contribution to the post-war international architectural scene. But Banham's claim is more far reaching than this, for he would like us to believe that the British contribution lay equally in a corpus of buildings which expressed these principles. This part of his argument is open to severe questions. If the work of such British architects as Peter Smithson and others did assume any degree of international importance during the period, it was not because of the buildings themselves, rather it was because of what Banham and others wrote or said about them. In other words it was the verbalization of the idea which counted, not the visual statement.

The tantalizing question raised by this book is that of the relationship between ideas and visual forms. Banham's discussion of the New Brutalism aptly indicates that there is indeed a decided interaction of the two; but the results of such interaction are highly independent. Thus an idea may prompt a designer to rethink his approach, but even the detailed explanation of the idea cannot foretell the form. As Phillip Johnson pointed out a few years ago, the source (or sources) of form are found in form, not in ideas about form. **David Gebhard**

STRUCTURE—FORM—MOVEMENT by Heinrich Hertel (Reinhold Publishing Corp., New York, 1966; $17.50)

This collection of studies in the relationship between biology and engineering records experiments and computations in such natural engineering accomplishments as the silent flight of an owl, the sonar of a bat, an oilbird, the early warning sonar and flight equipment of a moth, microstructures (the spiral reinforcement of bristles), the wing and bone structure and flight motion of birds, the shapes and structures of feathers, the hovering of hummingbirds (a lift current generator), the hook fastenings of burs, the bee fan blower, membranous wings, the propulsive movement and shapes of fishes (applied to aircraft), flying, fluttering, gliding fish, and slender swimmers, flight in the plant world; illustrated by photographs (well and worse printed), diagrams, graphs; supported by brief paragraphs of concentrated information plus scientific terminology and mathematics beyond the common reach. The author directs a Berlin institute for research in the design of flight structures. A totally fascinating and inspiring book to stimulate the inventive thinking of scientific generalists, technicians in all fields of design, artists and poets, an inspiration and check to all who believe that science cuts off intellect from life. Life is still as far ahead of scientific formulations as it is still more "mysterious" than the total lump of theological mysteries. If we are only beginning to conceptualize the flying of no longer "a bird" but a myriad of unlike birds and insects of totally differentiated flight, and the same no less of fishes, snakes, water-dwelling mammals, by what privilege do we feel able to conceptualize what we call "God"?

THE SANCTURARY OF HEMITHEA AT KASTABOS by J. M. Cook and W. H. Plommer (Cambridge University Press, London, 1966; $15.00)

This scholarly job, handsomely printed but illustrated by photographs as unrewarding and motley as snapshots, discusses the archeology of a shrine, originally small but later much enlarged, at a location which may or may not have been Kastabos, dedicated possibly to healing by incubation and perhaps not. Incubation consisted of giving the goddess an offering and then sleeping in her porch, in the hope that while walking at night she would heal the giver. Diodorus and Parthenius give unlike tales about a pair of sisters with different names, one of whom became the lady of the shrine. All the details, however, are conventional mythology applied elsewhere to other enshrined ladies, and the Hemithea means "demi-goddess." Every positive statement about this shrine and what was found there has been carefully contradicted by a negative statement, so that, while a specialist may indulge his speculations on the evidence, the common reader can only wonder what was the real purpose of exploring this site and how much was accomplished.

LIVING ARCHITECTURE: OTTOMAN, by Ulya Vogt-Goknil, photographs by Eduard Widmer, preface by Jurgen Joedicke (Grosset & Dunlap, New York, 1966; $7.95)

As offset to our western featuring of the "esthetic" aspects of architecture as "monument" in two-dimensional photographs or, by contrast, as "functional" building made beautiful by exclusion of all unnecessary trim, it is good to have a book like this. Jurgen Joedicke writes in his preface: "The historical development of Ottoman mosques is still one of the Cinderellas of the history of architecture. Yet it is one of the most fascinating examples of the beginning of an architecture rendered finite through space, an architecture which obtains complete identity of space and visual exterior form. Its renunciation of pictorial exhibition (be it plastic or artistic) leads to a reduction of all architectural elements to those that are exclusively space-defined." Space definition is one reason for my enthusiastic response to the Auvergne-Roman churches (not cathedrals) built during the 11th and 12th centuries in the villages around Clermont-Ferrand, structures relatively unornamented and quite distinct from the better-known Romanesque and Gothic.

The author provides a brief history of the Ottoman Empire, describes the relation of the complex of mosque buildings (built as community centers), explains the significance of site, water and greenery, and town center in the Turkish town, discusses the structural evolution of the mosque, religious and domestic architecture, decoration, light, minarets, rooms, pavilions and summerhouses, caravanserai and public baths (a Moslem must wash himself in uninterrupted sequence five times a day), and materials. The pictures are inspiringly practical and some very beautiful, the architectural drawings handsome and clear, and there are sketches in the preface from Le Corbusier's *Carnets de Voyage*. **Peter Yates**

notes

in passing

Cities as we know them have been made possible in physical health terms by the water-carriage system for waste. They are being made impossible, in part, by a further invention of that same city, the motor car. What new form of city would be made possible now by the application of its flow-line production techniques?

The operational aspect of industrialized system-building has been discussed at length—what society needs are system-built cities. Global economies escape us and repetition as practical is not acceptable.

Even the most sophisticated of present systems is medieval compared to the techniques that will be possible when composite materials can be fabricated to achieve and maintain the theoretical strengths of solids. The engineering equivalent of biological materials using ceramic filaments will enable present strengths of 10 tons per square inch to be raised by the power of 10 while retaining low densities, high stiffness, and corrosion resistance.

In our own lifetime, we have seen speculations on the form of the future city, from the garden city to proposals for a single-structure with a full-conditioned atmosphere designed to accommodate the life cycle of a whole community; from back-to-the-land to instant cities; from a linear settlement hundreds of miles in length to horticultural skyscrapers rising from parks. The technology of, for example, the automobile industry, let alone the space program, could do this and much more. Automatic retailing and the flexible house which turns with the sun are signposts we have passed. The world needs the equivalent of one new city every seven hours, and of a kind which bring new dignity. Under the stimulus of technological advances already in sight in communications, constructional techniques, and automation, and which could fundamentally change the structure and culture of communities, settlement patterns of the future will extend from hamlets to a kind of global urban lattice.

But whatever form our towns or cities take, our task is to discover the inherent latent order in society—our problems are not technological but philosophical. Today we are equipped with tools unknown in the past. We can plan by computer, ranking function, and by simulation-technique assign urban relationships.

We can drill metals with light and shatter concrete by sound. We could erect whole cities by self-propelling gantries, almost as a kit of parts, which could be assembled and reassembled in a variety of ways.

We come back to the question, to what end are we planning? Our situation is precisely Einstein's clarity of means and confusion of ends.

What of that part of the iceberg of social consequences of urbanization that we cannot so readily see—its effect on genetics, mental disturbance, delinquency, or respiratory disorders? Amongst the fundamental questions that we have to shrug off in the day-to-day work may be a host of environmental ingrained assumptions due for inversion.

All geographic change is accompanied by psychological change: in those who don't successfully transpose, vulnerability to exploitation will not necessarily disappear with the acquisition of a vocational skill. Regeneration must involve the whole social scene.

Urban programs often start with renewal of the city's physical plant, usually beginning with the obvious central business district. Urban generalists like Pittsburgh's James Cunningham argue that this could be a dangerous approach —they would place emphasis on its school system, and more on school methods than buildings; on the employment system, and administration of justice. Tools are urban renewal, education, manpower retraining, mobile health clinics, housing code enforcement, and planned integration.

The most spectacular movement for self-determination has been that of Saul Alinsky of Chicago. He aims for non-political entry into the decision-making process on behalf of the underprivileged. He believes that a merit case is not enough, there are those forces who will not even take time to understand it. Since his sector cannot exercise money-power, they must use people-power. He organizes for conflict, enjoins confrontation, and accepts compromise.

He requires the community to polarize, hence he dramatizes the issues. Some see him perpetuating tensions, or requiring external enemies against which to unite. He sees in this a creative climate.

In an era of change he is an alternative to violence.

There is a most fabulous design corollary. Cities could be different—we know how. The forces of resistance are apathy and sectional interest. If the will of the ordinary citizen could be harnessed, a new vision of city life could open.

Goffrey Copcut
Carnegie Review
Carnegie Institute of Technology

BUILDING THE GREAT SOCIETY: THE CHALLENGE TO THE CONSTRUCTION INDUSTRY BY **ALLEN TEMKO**

The tragic flaw of American civilization has been our failure to fulfill true potentialities. Never has human potential been greater than in our "open" society; rarely has it been so high; seldom, over the course of the Industrial Revolution, has the application of technology been relatively so far below feasible possibilities. For many complex reasons—reasons which the grandiloquent authors of the "The Great Society" thus far have not explored—the nation almost invariably falls short of optimum attainment in both the public and private sectors. The chief need of America, as President Kennedy recognized, is a profound commitment to excellence.

Physical ugliness, like social despair such as produced the Watts riot, is a direct outcome of this costly failure to achieve our full creative potential. Indeed, our very affluence and unrivalled technological power may have handicapped us in this respect. Engineering in Europe, where labor is cheap but materials dear, has often been more audacious and refined than our rather heavy-handed structural and mechanical design, which generally assumes a certain inevitable amount of waste. Bernard Shaw once defined ugliness as "waste of life"; and ugliness in this country is spreading with unprecedented speed under the resistless impact of social and technological change, at the rate of 3000 acres of open land "developed" per day, as the gap widens between our mediocre accomplishments and our superb opportunities.

Thus, in a nation which prides itself on "Yankee know-how," it is painfully clear that there is much that we do not know how to do. In particular we do not know how to expand productivity and, and at the same time, to keep the air clean, water pure, and soil uncontaminated. We do not know how to enlarge settlement patterns without despoiling the landscape, grievously complicating transportation problems, and leaving a trail of environmental wreckage in the aging urban cores and along the tawdry highway strips.

In the same way we can not, or will not, spare individual man the sight of crude overhead utility lines, just as we have not yet developed satisfactory energy and water systems for vast urban realms such as the Megalopolis of the Atlantic Seaboard. Similarly, as if we were not enough afflicted by neurasthenic advertising, we allow a regional despot such as Robert Moses—a darling of the construction industry for several decades now—to perpetrate a billion-dollar World's Fair as a gigantic TV commercial. This folly, which provided New York with not the slightest real improvement, was perhaps the nadir of conscienceless waste, at a time when traffic clogs the obsolete streets, schools and hospitals are woefully inadequate, air-conditioners are shut down in the abstract skyscrapers because of the water shortage, and Harlem festers.

In other words, America has not yet developed the political, social, and economic maturity to create a bio-technic civic order, commensurate to the new scale of urban expansion, emblematic of the finest contemporary humanism, and capable of satisfying not only man's basic physical and psychological needs, but also his "rising expectations."

Perhaps, and here I turn more directly to the construction industry to which all of these general charges may be applied quite specifically, we do not even know how to build individual buildings, much less entire cities, which are worthy of our own age. Apart from mechnical systems and minor structural features, virtually every building erected today could have been technically achieved early in the twentieth century or late in the nineteenth. With the exception of a few serious architectural and engineering firms, most designers are content—in Pier Luigi Nervi's scornful phrase—"to imitate the solutions of the past"; and the construction industry, again with some notable exceptions, confirms them in complacency.

Granted, there have been stirring innovations. Improved materials such as high-tensile steels and techniques such as prestressing have led to fresh architectural expressions; but as Myron Goldsmith has pointed out (and he is one of the first of the new scientific architect-engineers who wish to correct this situation), not much genuinely significant progress has been made structurally since Eiffel completed his 1000-foot tower in 1889, and Cottancin's triple-hinged steel arches spanned the 400-foot width of the Galerie des Machines the same year; or since pioneer Chicago modernists used reinforced concrete to enclose some 800,000 square feet of floor space in the great Montgomery Ward warehouse of 1908.

At the center of North America, in the prototypical industrial metropolis which was already the hub of the transcontinental railroad system, the Montgomery Ward warehouse—distributing an ever increasing variety of inexpensive but very decent goods through the U.S. mails—was an especially interesting early monument of the mass-consumption society which emerged after the first brutal phase of the Industrial Revolution. Only now, as the Age of Communications, Services, and Automation succeeds the earlier period of mechanization, is the new society commencing to hit its full stride. Although it may eventually enter a "post-his-

toric" stage, in which its complex dynamics will be stabilized, it presently is in an exhilarating state of flux: its material demands are still apparently limitless; its cultural requirements, including the need for amenities of every conceivable kind, have not yet been clearly articulated.

Thus far, however, these have been generally dealt with as separate demands, and in the contest for satisfaction, amenities have usually suffered (again, I am speaking relatively: there has been a decisive net gain in many amenities). The question remains, can the public acting broadly through government at several levels, as well as "private enterprise" acting more narrowly in our mixed economy, cope with the whole complex phenomenon as a single thing?

On the basis of the record in both public and private sectors during the period of rapid urbanization since 1945, the outlook is glum. The Indiana dunes, potentially an important recreational component of the Mid-Western Megalopolis now coalescing about the Great Lakes, are a case in point. Not only were federal, state, and local governments powerless to stop ill-advised encroachment on this precious scenic resource—which will seem doubly precious by the end of the century—but private industry, exemplified by Bethlehem Steel, arrogantly denied the public interest.

This was a spectacular, but far from isolated example of dog-in-manger attitude by a giant of the construction industry: Bethlehem behaved almost identically on the shores of San Francisco Bay, ruthlessly occuping Point Pinole which conservationists also wished to save as a park for an expanding regional metropolis. The steel industry, of course, is no more guilty than the lumber industry, which is now furiously cutting as many virgin redwoods as possible before they, too, are protected by public action. The cement industry also can be a terrible destroyer of amenity, ripping up hills and beaches, and polluting the atmosphere over hundreds of square miles from its exhaust stacks. The petrochemical industry, producing the plastics which must play an increasingly important role in construction, is also a massive disruptor of natural ecology.

On low-level flights over most of the country during my present research for the Twentieth Century Fund, I have been repeatedly stunned by the magnitude and ferocity of the construction industry's primary operations. Selfish industrial location and obsolescent procedures in older plants are only part of the problem, and the fault does not lie wholly with industry, which, receives little or no guidance, not to speak of "control," from government in these vital matters. Nowhere in the country, so far as I know, is there a coherent policy of plant location, formulated in terms of national, regional, and local interest; and nowhere, moreover, is there a comprehensive program encompassing both industrial expansion and residential development. South of Detroit, for instance, there would seem to be excellent sites for large-scale "planned communities" but huge cement plants—already in operation or soon to be built—have preempted key locations, without much attention given to wind patterns and other ecological factors.

If the construction industry truly wishes to create a more comely and orderly national environment, it can take the lead—rather than waiting for government to impose arbitrary formulas—in a sweeping program of regional improvement. Capital investment could easily be better co-ordinated in the public and private sectors; and, in large undertakings at least, every private action could lead to substantial public dividends, and vice versa, for example in the construction of mass-transit systems.

The big corporations especially, whose activities transcend local political jurisdictions, and which furthermore have the financial staying power to see long-range projects through to the end, could exercise a beneficent influence here, bringing the formidable talents of their own technical staffs to bear upon general environmental problems.

In a sense, modern corporate management would thus be merely resuming the role which powerful magnates—one thinks of the hard-headed railroad presidents who built the resplendent Grand Central and Pennsylvania Stations in New York—undertook early in the century, when the feral impulse of primitive laissez-faire had somewhat abated, and their thinking was able to go beyond the immediate "practical" needs of their companies. At their best, and I am aware that they were not often on good behavior, such men were authentic community builders: Carnegie as library builder, for instance, did not simply construct repositories for books.

Above all, they had a personal, even proprietary, commitment to the civitas which has since largely evaporated in the crucible of the "managerial revolution." Personal commitment on this order may well be beyond the grasp of all but the most powerful of the "organization men" of today, but a new, and I believe higher, commitment is clearly possible throughout the whole range of management. It would necessarily be a political commitment in the finest sense, part of the new politics that is striving to be born in this country, grappling with issues as diverse as freeway routes and juvenile delinquency, wilderness conservation and downtown densities, sewage treatment and cultural centers, slum clearance and ballparks.

Gradually, confusedly, but with increasing sureness, more Americans are trying to understand our fragmented, pluralistic society as a complex entity. Where that society functions poorly, or has broken down, as in the violent slums of Springfield or Rochester or Chicago, or in the phantasmagorical neon gambling strip beside polluted Lake Tahoe, the cause has been clearly a failure of politics, rather than of technology.

The bright machines—even the automobiles when considered in this context—are innocent. Men have made them, as they have made our cities, and it is up to men to make them work well, or to replace them with finer products. Thus modern environmental politics must be technically competent to a degree undreamed of even a generation or two ago. Indeed, it was incompetence in this field that made the recent White House Conference on Natural Beauty a travesty of a genuine environmental forum.

And it is here, because of its specific expertise, that the American construction industry might make a splendid contribution. Because that contribution is so urgently needed, other industries—most probably the aerospace companies which are now adventurously seeking to diversify their operations—will make it for them if they abdicate this responsibility. For the aerospace people comprehend what most construction men seem not to have fathomed, the physical environment is a complex of interacting systems, scarcely limited to finite buildings, which lend themselves to systematic analysis and design. In California, under a wise program of former Governor Brown, aerospace companies are dealing with several large-scale problems, including future transportation needs and waste disposal, both of which should strongly affect the construction industry.

Whoever may do the planning and design, construction men can argue that they will end up doing the building. But this is far from sure in a epoch of swift and incessant technological change. Experience would seem to contradict the assumption. The railroad builders did not manufacture automobiles, and the car manufacturers do not make the jets and rockets. A maverick corporation such as Litton Industries, which has shown keen interest in evolving environmental processes, may well enter the construction business on a large scale, and drive many competitors from the field.

All this is to say that the construction industry must change its historical posture. Paul Goodman has bitterly decried The Great Society (from which the construction industry stands to make sizable short-term profits) as "business as usual, only more so." It requires only a plain look at our cities, however, to see that this will not work if we are to double our existing stock of buildings before the end of the century, and simultaneously try to improve the overall quality of the environment.

So far I have reviewed (1) the appalling technological lag in the building industry, which is a good fifty years behind more advanced sectors of the economy; (2) the anarchic operating procedures of the industry itself which are frequently at odds with optimum regional development; and (3) the urgent need for the industry to take a more active, courageous, and enlightened role in environmental politics. By this I do not mean that thriving contractors in New York City should simply shift their allegiance from the venal Machine to a non-Machine type such as John Lindsay, but that the industry as a whole should participate creatively in community-building process, seeking not merely the profitable, but the best.

In discussing the industry in this way I have not forgotten that it is far from monolithic; that it is comprised by organized labor as well as by management which sometimes is scarcely organized at all; and that its major components, such as the home-building business, may be categorized almost as independent industries. Furthermore some of these elements are much more progressive than others: Marx was certainly right when he predicted that in highly developed capitalistic society management would be far more receptive to technological innovation than labor.

At times these difficulties appear insuperable in America, for example when union plumbers refused to hook up the installed fixtures of Rohr Aircraft's prefabricated houses in southern California, even though this made exceptionally good economic sense on outlying sites.

The intransigence of building codes, their capricious standards, and the comparatively low intellectual level of the officials who enforce them, present still other vexing problems, com-

plicated—like so much else in the industry—by abject collusion between labor and management.

Yet this is the only building industry that we have at the moment, and even if it is eventually revolutionized by fresh entrants to the field, we must strive nevertheless to make it decisively better for the time being. Reactionary unions, timid management, unwieldy government bureaucracies can all be made to perform at a higher level if they are given a push. Such a push may come from market competitors: mobile home producers and entrepreneurs, with their rationalized installation methods (such as single trenches for all utilities) and their favorable position vis-a-vis contractors and unions, have already made deep inroads on the conventional housing market.

A different kind of push, much stronger, can come from the nation's intellectual leadership. Heartening progress has been made in this direction by a brave experiment, the School Construction Systems Development Project, sponsored by the Educational Facilities Laboratory (which in turn is supported by the Ford Foundation). Under the direction of the brilliant young research architect Ezra Ehrenkrantz, who has previously studied systems-building and modular co-ordination in Britain and other European countries which made substantial progress in rationalized building fabricators, were invited to submit proposals to meet performance specifications, rather than conventional code. These specifications, moreover, were based on advanced educational theory, and not merely on building requirements. Significantly, too, bids were to be made on the basis of completed work in place, for the client assembled by the Educational Facilities Laboratory was a consortium of twenty-three California school districts widely scattered throughout the state.

The first result was the splendid prototype structure which stands on the Stanford campus, a model of economy and architural excellence, which comes well within the budget of the State's aid program for school construction even though it is air-conditioned—something never before achieved at this price. The air-conditioning system by Lennox is outstanding, but to me the most interesting feature of the school is the ingenious structure developed by Inland Steel, with its remarkable lightweight folding truss, which can be delivered by flat car from Milwaukee. Inland and the other fabricators are already marketing these components outside of the experimental program. Inland's system, for instance, is being used for a new Lockheed structure which was urgently required for defense needs (which unfortunately has thrown the school building schedule out of whack, perhaps because the construction industry—like most of the American economy—is inclined to act more swiftly for armaments production than for something as purely cultural as a school).

This experiment in rationalized building has brought new clients forward: Ehrenkrantz will be consultant to the University of California in a dormitory construction program which the Educational Facilities Laboratory will jointly sponsor; and his group is also working on shopping centers and other facilities for James Rouse, that intrepid developer who has embarked on the most promising planned community yet started in the United States: the New Town of Columbia, Maryland.

Columbia, of course, is only one of some 250 "planned communities" which are either proposed or actually under construction in United States. Aside from nearby Reston in Virginia, where high architectural standards have been maintained so far, the others have been crassly conventional—indistinguishable, in fact, from ordinary subdivisions which surround them. Technologically, too, they have been extremely backward. Clear Lake City, the "space city" outside Houston jointly sponsored by Humble Oil and Del Webb, is a preposterous parody of our creative ability in an epoch when we are preparing to send men to the moon. None of the exquisite aerospace technology evidently rubbed off on Mr. Webb's cohorts, probably because no one was interested. This famous "builder" is the type I would call a "non-builder": nothing he has done, so far as I know, is architecturally worth saving for the next generation.

How long can the construction industry continue in this way? It would be comforting to think that Mr. Webb represents the end of something, rather than the beginning. Quite possibly he is one of the last of the old-style, big-time contractors, just as William Zeckendorf must be one of the last of the old-style real estate speculators on the grand scale. In spite of the superior quality of his architecture, for which he deserves praise, Mr. Zeckendorf found himself swamped by tremendous forces over which an individual entrepreneur, no matter how adroit, must inevitably lose control if he tries to operate on the Zeckendorf scale.

Not at all accidentally, the Zeckendorf "empire" was salvaged by Alcoa. To the chagrin of hopeful observers who have studied the building techniques of this mighty corporation, precious few of its powerful research and development resources were committed to the challenging task of community building. Alcoa in many respects did not even adhere to the high architectural standards of Mr. Zeckendorf, even though one division of the company may have sold some extra aluminum to another.

Neither Alcoa nor Reynolds, which is almost identically guilty on this score, has put up buildings that any ordinary developer could not have done as well. Significantly enough, they have not even seized the chance to use aluminum structuraly, although this marvelous material would seem ready for a structural breakthrough that could lead to a polychromatic architecture (which need never be painted) of exceptional elegance and richness. Not to neglect their even less imaginative competitor, Kaiser Aluminum, I am bound to remark that the Kaiser House, which should have been a radical contribution to residential architecture (at the very least it should have been as good as the Monsanto House at Disneyland), cravenly simulated wooden siding, hung on a structural frame that was really wood. It remained for an uncompromising modern architect, Raphael Soriano, to convince a modest developer in Hawaii, with no help from the aluminum companies, that he should build a fine group of logically designed, low-cost, insect-proof, all-aluminum houses on the island of Maui. These, like the prototype school at Stanford, should be a lesson for the entire construction industry.

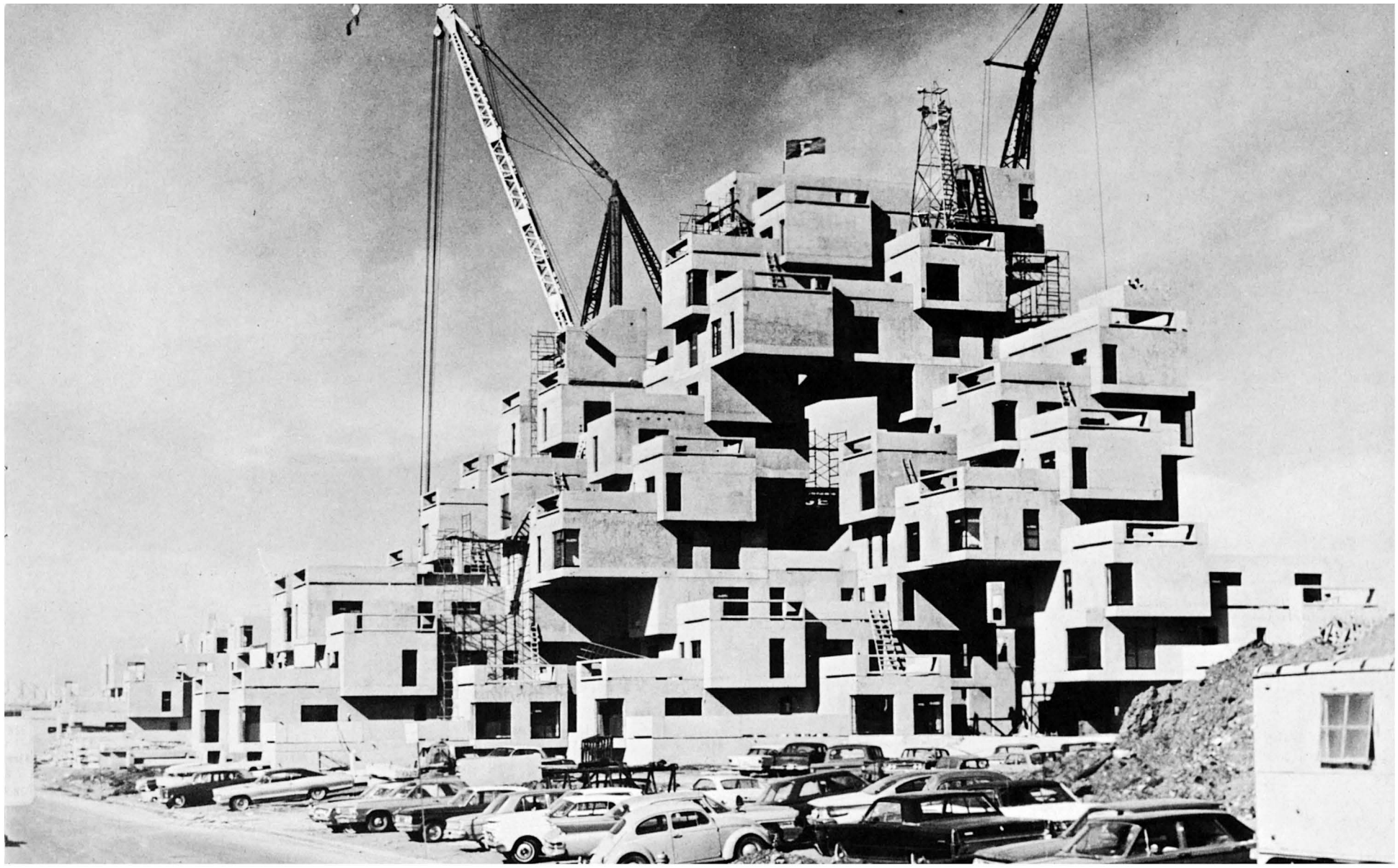
The record of the big corporations has not been uniformly poor although it has been far below potential in almost every case except that of the adventuresome glass companies (which alone in the whole field of construction have spent about what they should have in pure and applied research).

One is forced to wonder, indeed, if they are as unaware of their real advantages as they are of their fundamental responsibilities to the nation. Bigness, which can lead to such evil, also may be a tremendous force for good. Both Alcoa and Reynolds can now be recognized as vertical building trusts which extract raw materials, refine them, fabricate building components, erect the actual buildings, and—here is the snapper which eventually may interest the anti-trust division of the Department of Justice—retain ownership of buildings and land. Considered legally, this would seem not much different from the automobile companies retaining ownership of cars, or the movie industry owning theaters, something it has now been forbidden to do.

Nevertheless, speaking as a radical who would like to see sweeping changes in our environment, I hope that the aluminum companies will continue in this new role, acting more boldly and wisely, making the most of their opportunities. Logically they should act together with producers of mechanical systems such as General Electric, which has also entered the building field (although for the wrong reason: to assure themselves of a good chunk of the appliance market). GE's staff is already investigating possibilities of complete community systems, including micro-transportation systems of electrically-powered vehicles, and total energy systems for all-electric structures.

Why could not Alcoa, GE, and a number of other corporations show the United States and the world how communities can really be built in the last third of the twentieth century? Although they can well afford to finance such an undertaking themselves, it would seem entirely proper for government to sponsor research which would be of only marginal interest to the companies involved. These could be communities which not only work technically, but socially: they could be truly integrated on every level, with a population as well balanced according to income distribution and race as the transportation system would be balanced according to private vehicles and public conveyances. Because of the financial strength and national scope of the sponsoring corporations, such communities need not be confined to affluent areas such as the Pacific Coast. A whole chain of such communities could appear in Appalachia, where our present pathetic community-building program is little more than highway construction and do-it-yourself house renovation.

This would be the straightest and broadest route to The Great Society. To build it requires a marshalling of national energies such as we have achieved hitherto only in wartime. Whether America is equal to so civilized a task is a question confronting not only our Republic but the the world at large. In Vietnam today we are pitilessly demonstrating our capacity to destroy. Here in our own country, where we have permitted so much to be ravaged by piecemeal thinking, short-term profit-taking, and misunderstood technology, time may be short, but the New Frontier opens wide before us in a myriad of opportunities. There is still time to build, if only we have the necessary courage, intelligence, and love.



HABITAT 67 BY **MOSHE SAFDIE & DAVID, BAROTT, BOULVA ASSOCIATED ARCHITECTS**

World Fairs tend to stew the architect in his own juice. Freed from the customary restraints of industry, labor and the marketplace, he displays his giddy excesses for all the world's builders to see and they come away with convictions reaffirmed: a domesticated architect is an uninsurable risk and an unfettered one is almost certain disaster.

Architecturally EXPO 67 looks to be no different—an expensive display of conceptual poverty, a $300-million frug, a middle-aged archidelic freak-out.

Habitat 67 is one of a few projects indicating an attempt to spend millions responsibly. The architects have tried, as Moshe Safdie said, "to meet the need for more intensive use of land and to develop and utilize new building methods to meet the challenges of expanding urban population, traffic congestion and suburban sprawl."

The basic elements are 17′6″ x 38′6″ x 10′ concrete boxes totally prefabricated on the site. They are precast in steel molds and steam cured. All fixtures and finishes—kitchens, bathrooms, window frames, insulation, etc.—are installed using assembly-line techniques and the boxes taken by travel lift to a crane which hoists them into place.

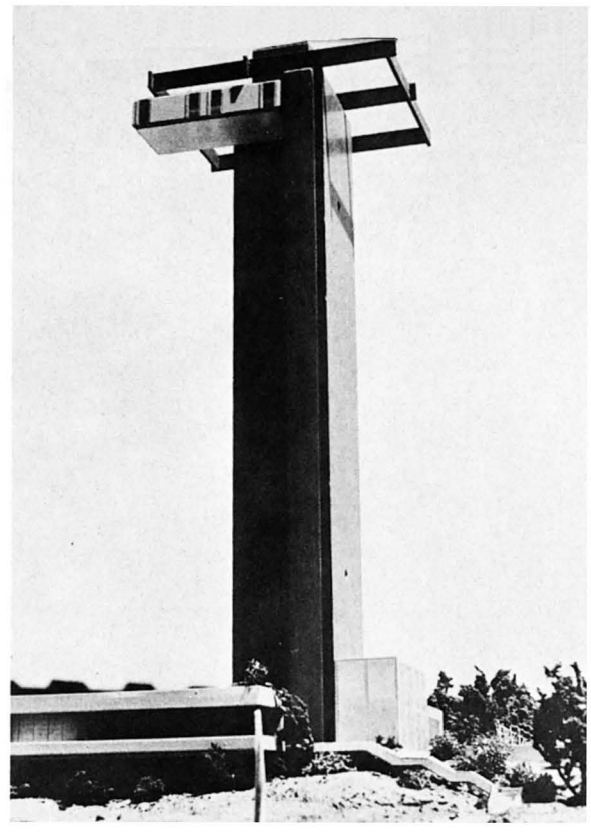
The 158 housing units vary in size from 600 square feet (one bedroom) to 1700 square feet (four bedrooms); each has its own terrace and garden on the roof of the unit below. Pedestrian and auto circulation are separated with houses tied to pedestrian streets at the fifth and ninth floor levels. Playgrounds adjoin the "streets."

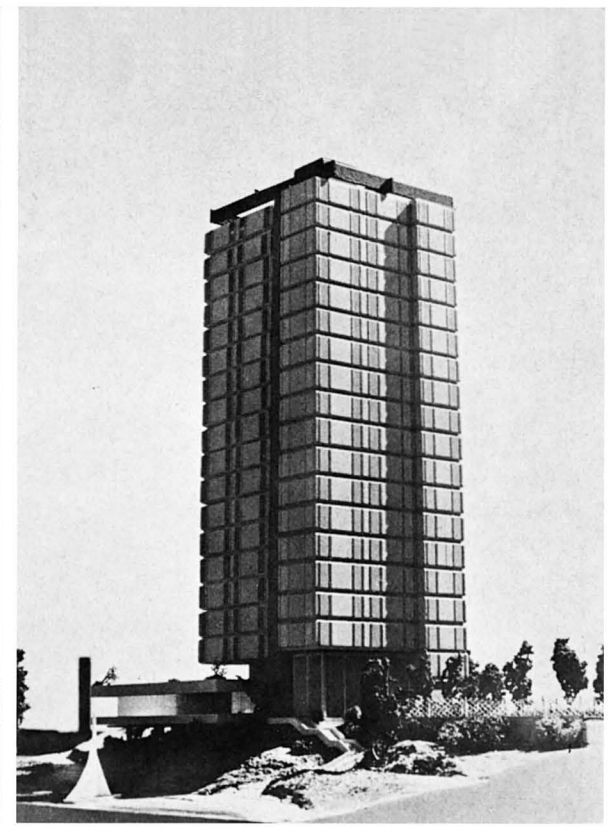
Overall cost allocation was $13.5 million (including a reported $1 million for the crane)—an average of $80,000 per housing unit, the majority of which have two, three and four bedrooms. Increasing the number of units would, of course, reduce the average but hardly enough to make Habitat commercially attractive.

If architecture cannot be both socially responsible and financially sound, then there is something amiss—with our industry, our social values, our architecture or, what is most likely, with all of them.

SUSPENDED SPACE-CELL SYSTEM BY **CHRISTIAN FREY**

This system developed by Suspended Structures, Inc., attempts to deal with the acute problem of multi-story construction, particularly in public housing, hospitals, educational facilities, housing for the aged, etc. The increased costs and shortages of skilled craftsmen compounded by the hegemony of the manufacturer, and the incapacity of the architect to think beyond the column and beam have, says Frey, "left architecture in a state of frozen immobility . . . In the area of design we cannot expect progress—the more so because of the lack of communication between architects and manufacturers. The natural area for progress is in production, because production responds to progress where progress means economy . . . The only possible solution is mass fabrication and industrialization. If we now built automobiles by the archaic methods that are standard in the building industry, our Chevrolets would cost about $30,000 instead of $3,000."



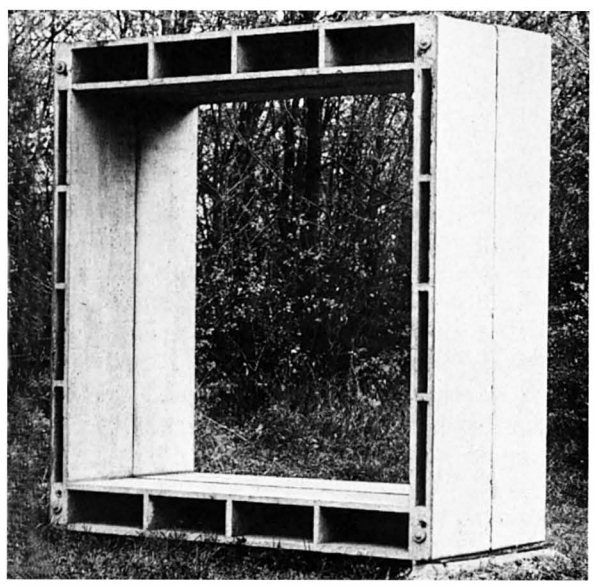


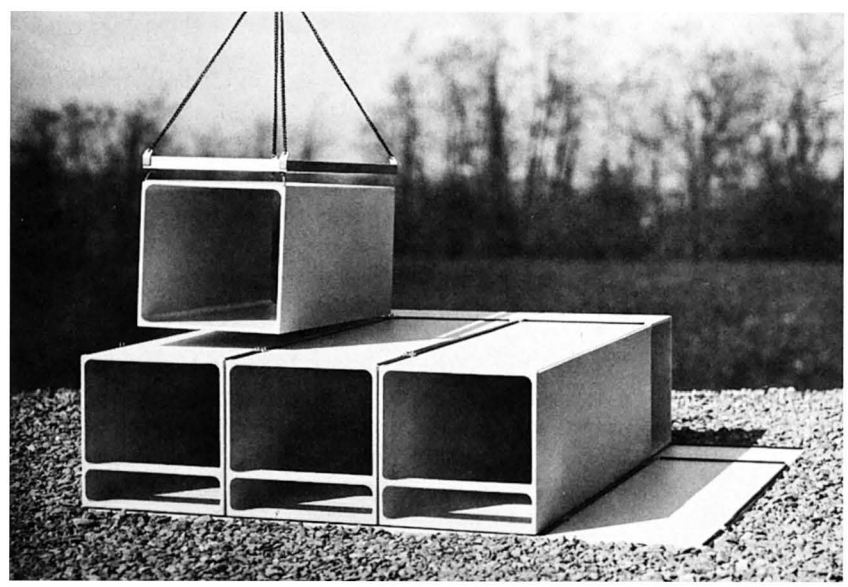
PREFABRICATED SPACE-CELL SYSTEM BY **HERBERT OHL**

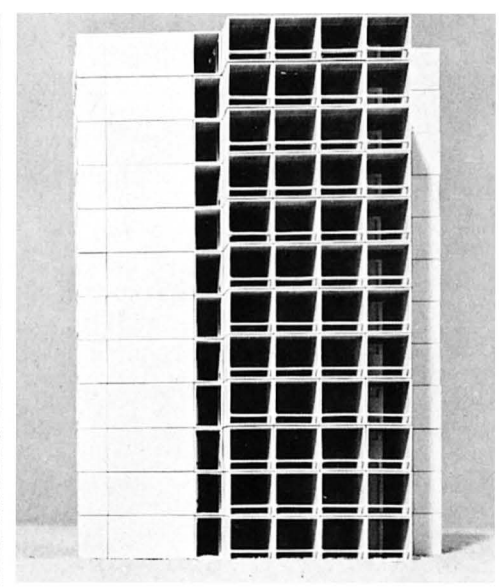
Like Habitat 67, this prefab space-cell unit system developed by Ohl, director of the *Hochschule fur Gestaltung* at Ulm, is an attempt at an industrialized building that disavows the last few generations' efforts. The architect's colleague at Ulm, Tomas Maldonado, has said of the earlier attempts, "The ambitious program of industrializing building has ended in the clumsy and indiscriminate use of the curtain wall" and "the glorification of construction details."

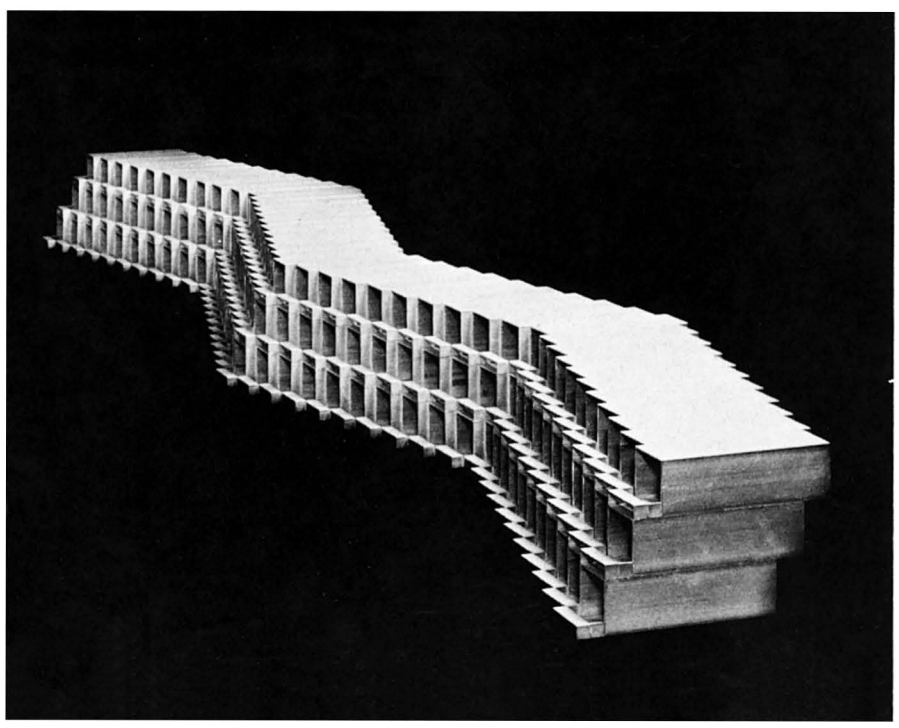
These standardized cells of reinforced concrete can be utilized in all types of residential buildings. As with Habitat, there is a high degree of prefabrication with fixtures, finishes, insulation, etc., built-in at the fabricating plant. Instead of being cast whole, however, Ohl's cells are composed of double-shelled rings or toruses joined by bracing rods run through pipe channels cast into the rings.

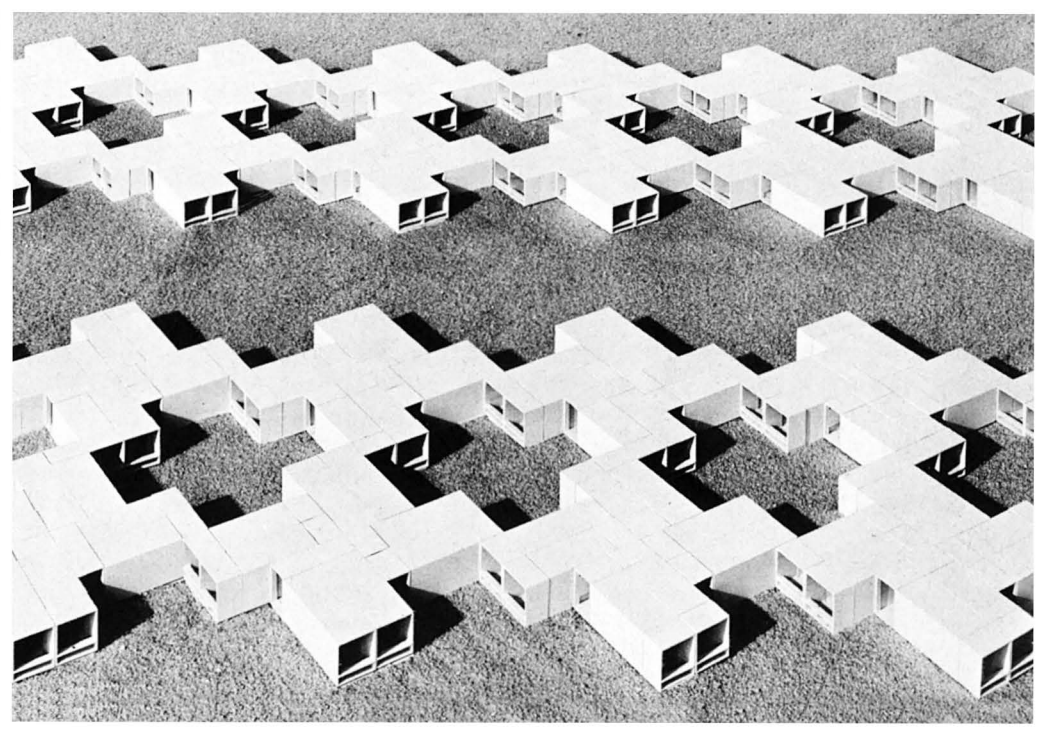
For a more complete presentation of this system see *A & A*, July 1966.











MODULAR MATERIALS AND DESIGN FLEXIBILITY

EZRA D. EHRENKRANTZ

The term "module" is indicative of order. It should represent a conceptual framework to operate in, rather than a specific dimension or grid. Its validity is due to the fact that modular components relate to one another like notes on the musical keyboard. The architect, contractor, and mason understand the module as the composer, conductor, and pianist understand the keyboard. It is this sense of order which makes it possible to construct an efficient building. In this context, the module is the stave of architecture. It does not determine the appearance of a building but provides a dimensional framework for its construction. Any design concept used to enclose space requires continuity of both structure and enclosure. The various parts of the building must fit together according to a mathematical relationship determined by the designer of the building. This is not unlike the case of the composer for whom the frequencies of given notes replace dimensions. He may choose his note and key, but the musical scale provides for order and understanding. The musician would not think of cutting ten vibrations per second from a note as we cut ten inches from a building product.

The order implied by the keyboard is absolute, but its capacity for variation is infinite. The module in architecture also denotes discipline and freedom. Building products manufactured in the factory by machine should not have to be altered at the building site by hand. They should fit together to enclose space in a manner desired by the architect. The quality of the design is up to the architect, but the efficiency with which a building is constructed is dependent upon the dimensional relationship of its parts to one another.

In the past this relationship was based on the use of handcrafted components, but today we must achieve order using the tool- and die-maker as our craftsman. The opportunity to obtain a sense of order in our buildings is by no means diminished by the use of machine-made products, for the basis of order both past and present is mathematics. Proportion and dimension have always been related in architectural design, even though a mythology of aesthetics has frequently obscured this fact.

Today we can no longer afford to work with handmade products wherein the proportion of a component is fixed but the size varies. Modern technology demands that products be produced to fixed sizes. The former freedom to obtain products of any size is not only uneconomical today but will become impossible in future automated factories. As one must combine in a single design the fixed sizes of many manufacturers' products, it is obviously necessary that these components relate to one another.

The easiest way to do this would be to choose a fixed size and have all products relate to it. This fixed size may be thought of by some as a small dimension which may be multiplied any number of times to obtain larger product sizes. Others may consider it to be of greater magnitude and relate it to a structural or planning grid. In both cases, the concept of the module carries with it a simple sense of order.

In design this type of order may be obtained in other ways as well: by rhythms of two or more dimensions, or by proportional relationships of different sizes. It may also be established in a more random manner where no order is apparent to the onlooker but only to the men involved in the construction of the building as the space is enclosed with standard building products. The module then need not be apparent to a casual observer, although, in cases where the sense of order of the building is simple, it may be discerned as a grid, rhythm, or a line along which the corners of many products fall.

The fact that buildings are three dimensional makes it difficult to join the walls of a building together in a simple manner. Fig. 1 illustrates the difficulties caused by the thickness of building products when used to turn corners. If one tries to design an extremely simple modular building where the bay spacing remains constant, the solution of the thickness problem may involve a complexity of detailing which belies its authentic simplicity.

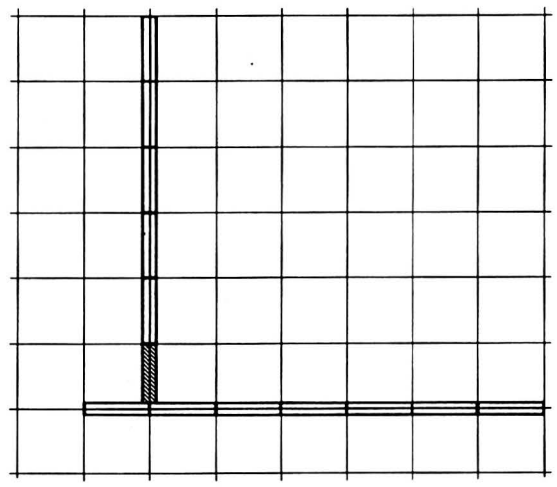
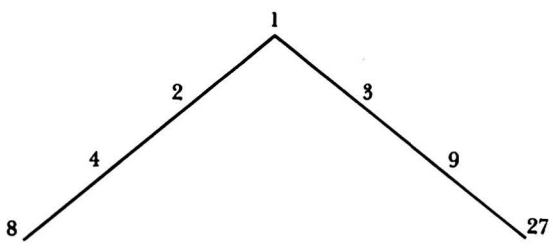


Fig. 1. Single panel size used with center line grid: the joining panel must be a special size.

In earlier periods, proportional systems were evolved that solved the thickness problem. Size was not important, only ratio for the fitting together of large stones and the consequent enclosure of space. Stones of one size could be cut as easily as those of any other, so that the ratios of these stones to one another assumed greater importance than their dimensions. The Platonic Lambda offers a good illustration of this point.



It consists of two series joined, as shown here, one being the doubling series: 1, 2, 4, 8 . . . and the other the tripling series: 1, 3, 9, 27. . . . The Platonic Lambda has been surrounded by an aura of mythology which has obscured its logic. The Greeks considered 3 to be the perfect number because it had a beginning, a middle, and an end and 3 × 3 × 3 gave sufficient scope for any numerical expression. Also, these two series provided the ratios used for various musical intervals: 2 : 3 is a fifth, 3 : 4 is a fourth, 8 : 9 is a tone, 1 : 2 is an octave, etc. These two series provided the basis for harmonic proportions, which has been described in detail in Rudolf Wittkower's book, *Architectural Principles in the Age of Humanism* (London, 1952). Other proportional relationships were developed by the Greeks based on dynamic symmetry or fractional proportions. The best known of this group of proportional systems is the Golden Section, upon which Le Corbusier developed his Modulor.

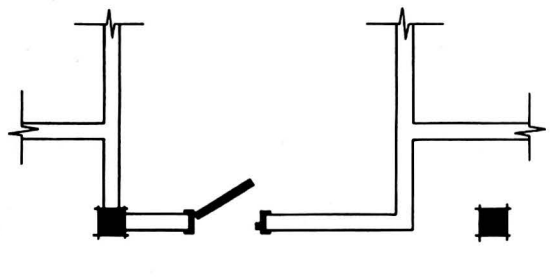
The basic value of these proportional systems in terms of building is that a group of product dimensions may be established on the basis of a proportion other than a whole-number ratio such as 3 : 5, and the products of one of these proportional systems will fit together so as to enclose space. Although it would indeed be impossible to enclose space using a group of standard products developed on a ratio of 1 : 1.55 or 1 : 1.64, it may readily be done with products developed on a 1 : 1.618 ratio.

The ratio of 1 + 2 = 3, 2 + 3 = 5, 3 + 5 = 8, 5 + 8 = 13, and 8 + 13 = 21. The ratio between two consecutive numbers is 1 : 1.618.

Thus dynamic symmetry does permit products of other than whole-number ratios to be related together so that a building may be constructed with standard elements. The interest of a facade designed on this basis is partially due to the fact that the relationship of the products to one another is more subtle than in the case of the repetition of 4′ x 8′ sheets of plywood.

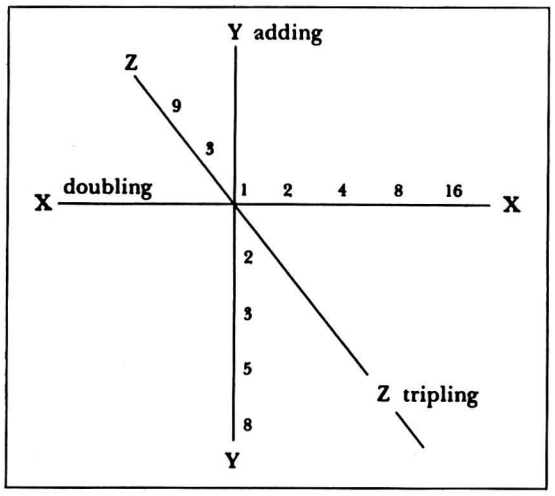
The use of these proportional systems and the bonding capacity of masonry construction made it possible to solve the thickness problem in the past. Today we must work with relatively thin mass-produced elements which do not have the bonding capabilities of masonry construction. Unfortunately, industry does not supply groups of standard products which offer architects sufficient flexibility to meet the functional and aesthetic requirements of their buildings, and so they must order nonstandard sizes. This is done to such an extent that many manufacturers cannot set up adequate production lines to produce standard sizes and keep up with the orders for specials. They must therefore set up assembly lines which operate on a comparatively inefficient basis of batch production with a resultant increase in the cost of their products. Their salesmen then offer the architect any sized component at little or no additional increase in cost, as all products are priced as specials. This situation is not beneficial to the architect or to the manufacturer. The difference in cost per square foot between standard and special products is bound to increase with our improving technology.

Actually, manufacturers would produce building products to any size. All they want is direction from architects to determine which sizes to produce and then the cooperation of the profession in using them. Architects, on the other hand, desire product ranges which give them flexibility and choice in design. The nature of lightweight and thin modern construction requires a considerable degree of flexibility to cope with corner and other joint conditions, as we have illustrated in Fig. 1. This situation becomes even more complex when structural elements and doors are added, as shown in the figure here below.

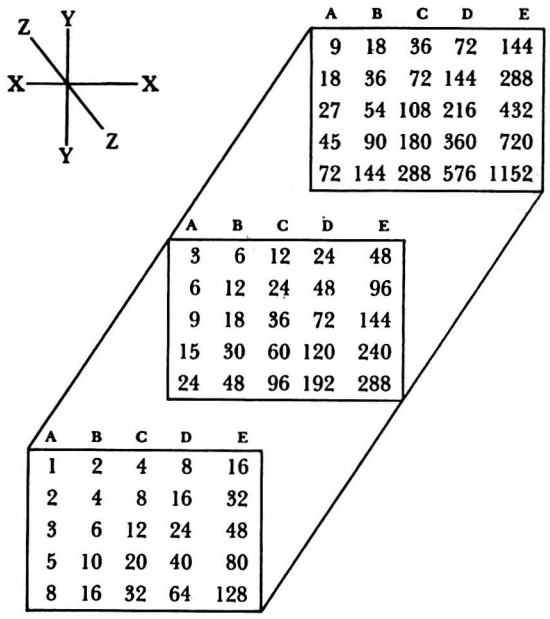


In order to break this impasse of the need for standardization on the part of industry and flexibility on the part of the design profession, it is necessary to develop some sort of keyboard for the sizing of building products so that industry can be assured of sufficient volume to make the production of a variety of product sizes feasible. In trying to develop such a related group of dimensions while working on a modular coordination project at the Building Research Station in England, it was interesting to note that those systems of numbers which appeared to solve the problem best were related directly to the mathematics of previous systems of proportion.

If we try to join the Platonic Lambda with the Fibonacci series we get a pattern as follows:



As shown here below, we may then fill in the dimensions based on this pattern, where we double along the *X* axis, add along the *Y* axis, and triple along the *Z* axis.



This grouping of dimensions has been termed the "Modular Number Pattern" and includes the various dimensions shown in Table I.

144″	60″	18″
135″	54″	16″
128″	48″	15″
120″	45″	12″
108″	40″	9″
96″	36″	8″
90″	32″	6″
81″	30″	4″
80″	27″	3″
72″	24″	2″
64″	20″	1″

Table I: Dimensions above 1″ Excluding Fractions

If we analyze this group of dimensions we find that all the prime numbers (odd numbers which cannot be divided evenly) above 5 and their multiples are eliminated. This means that this group of dimensions has the maximum number of combinations for fitting products together in different ways. This allows flexibility in design. From an engineering viewpoint, one could not choose a better selection of numbers as a guide to variety for the building industry. In light of this, it is my belief that the Greeks originally evolved an efficient dimensional basis for construction and then rationalized it in mythology.

We may utilize the dimensions of the Modular Number Pattern to show the musical ratios. Table II shows the scale of C major. At the time that work on the Number Pattern was developing, there was much speculation as to whether the key of E would be as sterile in architecture as it is in music.

Major Scale Key of C					*Number Pattern Dimension*
C	$1.00 \times^{0}$	Base	= 1 : 1	= 1.00	24″
D flat					
D	$1.12 \times^{2}$	Tone	= 8 : 9	= 1.13	27″
E flat					
E	$1.26 \times^{4}$	Third	= 4 : 5	= 1.25	30″
F	$1.33 \times^{5}$	Fourth	= 3 : 4	= 1.33	32″
F sharp					
G	$1.50 \times^{7}$	Fifth	= 2 : 3	= 1.50	36″
A flat					
A	$1.68 \times^{9}$	Sixth	= 3 : 5	= 1.67	40″
B flat					
B	$1.89 \times^{11}$	Seventh	= 8 : 15	= 1.88	45″
C	$2.00 \times^{12}$	Octave	= 1 : 2	= 2.00	48″

Table II: Diatonic Scale Using Keyboard of J. S. Bach

The importance of the various proportional systems rests basically in the fact that they provide relationships by which the aesthetic nature of a building may be understood. It is just as valid, however, to design in a random manner creating other less ordered but just as interesting visual relationships. The variety of design approach, be it keyed to a grid, rhythm, proportion, or to a random relationship, may all be modular. Therefore, although proportion and size are the basis of modular construction, the module is not determined by a specific proportion or size. For if products of fixed dimensions and ratios will not fit together at the building site, modular construction is impossible. A sense of order is implied, but the way in which it is achieved is up to the designer. Unfortunately, to date, comparatively little imagination has been used in modern architecture in the development of successful modular buildings. All too frequently, they consist of a simple repetition of a single product so that consequently the use of standard components or prefabrication is generally believed by the public to result in sterile architecture. The same may be said of "Chopsticks" in music which, in its simple state, is actually much more sophisticated than our repetitive buildings.

If we accept the fact that a single product of a fixed dimension cannot solve the basic building problems, and if we seek to develop a group of products capable of handling the various requirements, it may be possible to find a solution. If instead of only working with a single product of 4′0″, we use two—one of 3′0″ and the other of 4′0″—our design flexibility increases from 4′0″ to 1′0″, as shown in Fig. 2. This results from the fact that the difference between the two products is 1′0″. Therefore, if we add a 2′6″ dimension, we obtain flexibility

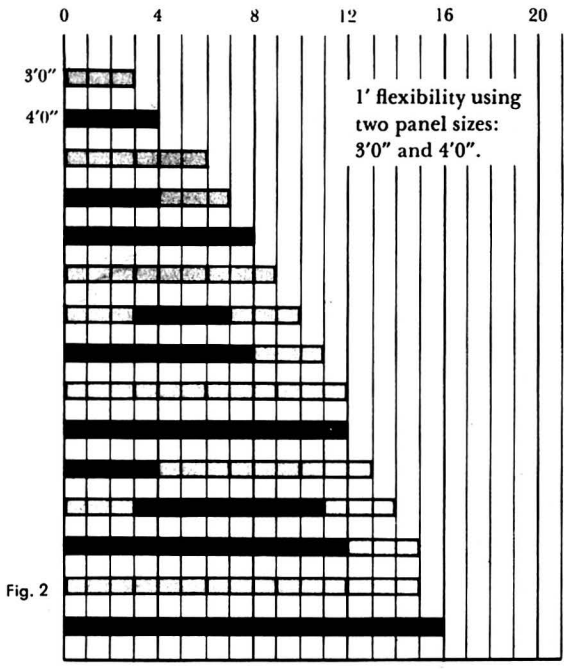


Fig. 2

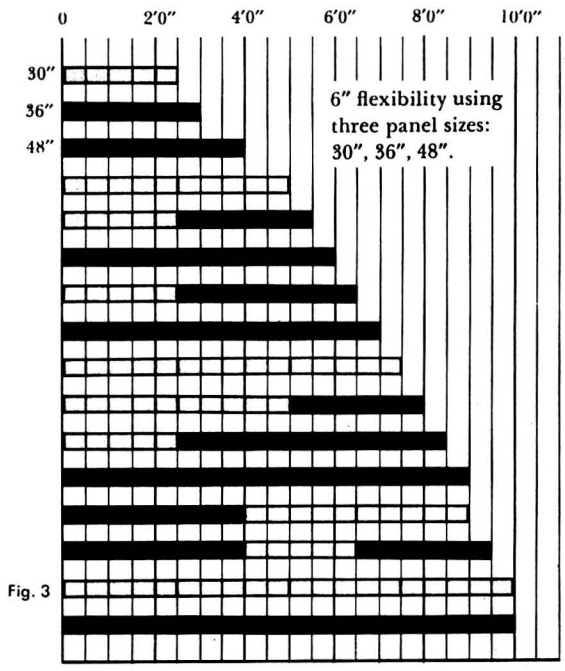


Fig. 3

to 6″, as the difference between 30″ and 36″ is 6″, here illustrated in Fig. 3. With four sizes —24″, 32″, 36″, and 40″—we can obtain 4″ flexibility as shown in Fig. 4.

With the development of product ranges that have the potential for design flexibility equal to the thickness of the product itself, it becomes possible to plan a building as though it were laid out on graph paper (Fig. 5). This enables the designer to solve some of the thickness and corner problems mentioned earlier.

The fact that flexibility to small increments may be obtained by using large product sizes is of considerable significance as the present tendency for mass-produced building components is toward the use of larger and more efficient factory-made products. Neither good nor bad design need result specifically from the use of product ranges developed in this manner. There is clearly considerable scope for the designer. Good design is the result of the effort of a talented person or team of people. A modular system should provide a scale or keyboard which enables the designer to express himself freely while working with a coordinated group of standard products.

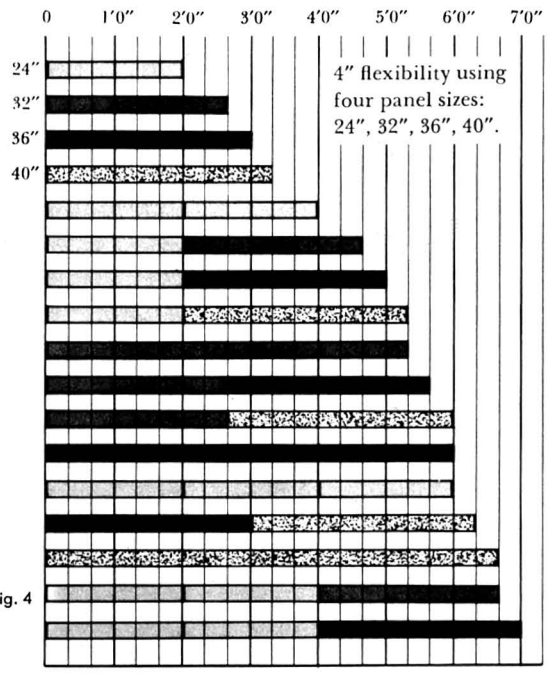


Fig. 4

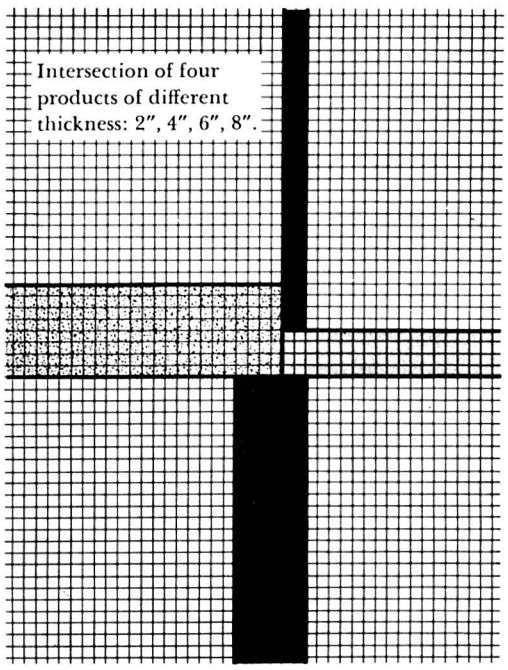


Fig. 5

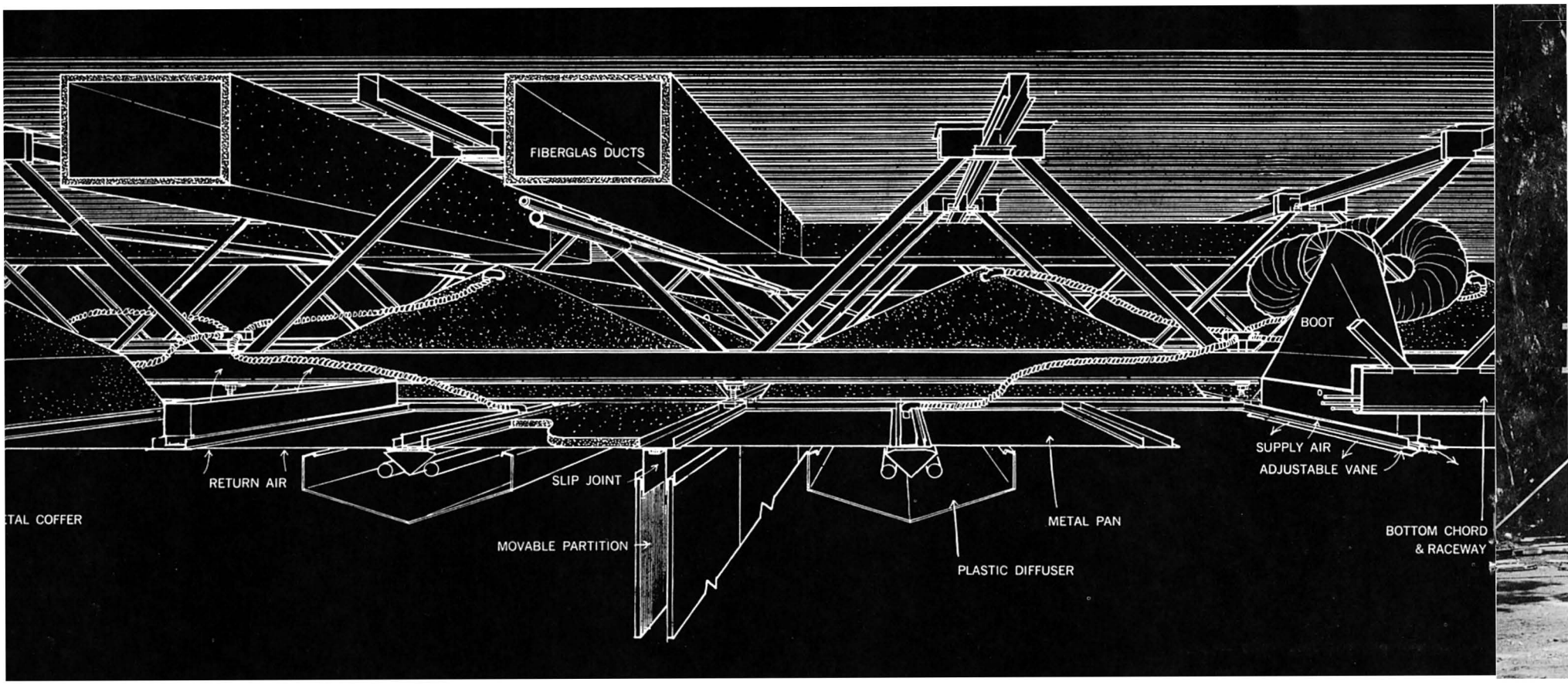
The relationships of numbers discussed in this paper have been used in setting out the requirements for the School Construction Systems Development program (see pages 16-21). It has been designed with standardized components and embodies several co-ordinated modular systems: 5′0 ceiling modules (appropriate for lighting, ventilation, and structural framing); 40″ partition panels (related to doorways, stairs, and corridor widths); and a basic vertical module of 2′0 (a reasonable minimum increment of ceiling height). In the interior view shown here a 2:3 ratio has been used between ceiling and partition products. The former relates to the length of a flourescent lamp and the latter to a door.

Photo by Rondal Partridge

Sonora High School in Fullerton, Calif., by W. E. Blurock & Associates.

Table III: 4″ Flexibility Using Six Product Sizes

20	24	36	40	48	60
5′0″	20 + 20 + 20		5′4″	24 + 40	
	24 + 36			24 + 20 + 20	
	20 + 40		6′0″	24 + 24 + 24	
	60			48 + 24	
				36 + 36	
5′8″	24 + 20 + 24		6′8″	20 + 20 + 20 + 20	
	48 + 20			20 + 20 + 40	
				40 + 40	
6′4″	36 + 20 + 20			36 + 24 + 20	
	36 + 40			60 + 20	
			7′4″	24 + 20 + 24 + 20	
7′0″	24 + 20 + 20 + 20			24 + 40 + 24	
	48 + 36			20 + 48 + 20	
	24 + 36 + 24			48 + 40	
	60 + 24		8′0″	24 + 24 + 24 + 24	
	20 + 40 + 24			48 + 24 + 24	
				48 + 48	
7′8″	24 + 20 + 24 + 24			36 + 24 + 36	
	24 + 20 + 48			20 + 20 + 36 + 20	
	36 + 36 + 20			36 + 20	
				20 + 36 + 40	
				36 + 60	
8′4″	20 + 20 + 20 + 20	+ 20	8′8″	24 + 20 + 20 + 20	+ 20
	36 + 24 + 20 + 20			24 + 20 + 24 + 36	
	20 + 20 + 20 + 40			24 + 20 + 40 + 20	
	40 + 20 + 40			24 + 40 + 40	
	36 + 24 + 40			60 + 24 + 20	
	60 + 20 + 20			48 + 36 + 20	
	60 + 40		9′4″	24 + 20 + 24 + 20	+ 24
				48 + 20 + 20 + 24	
9′0″	24 + 20 + 20 + 20	+ 24		40 + 24 + 24 + 24	
	24 + 24 + 24 + 36			40 + 48 + 24	
	48 + 20 + 20 + 20			40 + 36 + 36	
	48 + 24 + 36			20 + 20 + 36 + 36	
	60 + 48		10′0″	20 + 20 + 20 + 20	+ 20 + 20
	36 + 36 + 36			20 + 20 + 20 + 20	+ 40
	60 + 24 + 24			20 + 20 + 40 + 40	
				24 + 36 + 20 + 20	+ 20
9′8″	36 + 20 + 20 + 20	+ 20		24 + 24 + 24 + 24	+ 24
	36 + 20 + 24 + 36			24 + 36 + 24 + 36	
	20 + 40 + 36 + 20			24 + 36 + 20 + 40	
	36 + 40 + 40			40 + 40 + 40	
	60 + 20 + 36			60 + 60	
	48 + 48 + 20			60 + 20 + 20 + 20	
	24 + 24 + 48 + 20			60 + 36 + 24	
	24 + 24 + 24 + 24	+ 20		60 + 20 + 40	
				48 + 48 + 24	
				48 + 36 + 36	
				48 + 24 + 24 + 24	



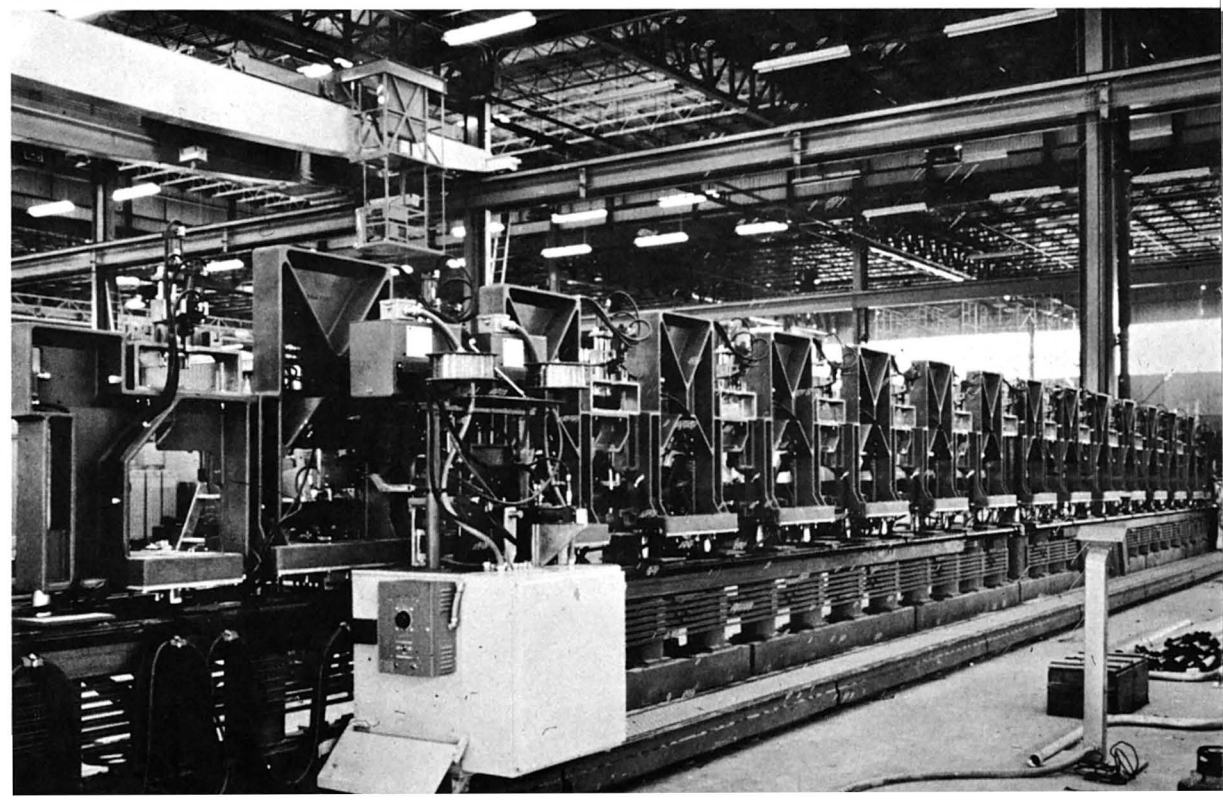
SCHOOL CONSTRUCTION SYSTEMS DEVELOPMENT PROGRAM

The SCDS program financed by the Ford Foundation is one of the most recent and successful large-scale efforts to overcome the forces, active and passive, which have worked singly and in concert to prevent the development of more efficient and rational construction techniques. School architects, and most others, are at the mercy of the manufacturer and must design their buildings within the limits of standard catalog products developed in the main for general rather than particular building types. School design is by and large a job of bending and fitting together bits and pieces, trying to make them conform to special needs.

The six-man SCDS team, headed by project architect Ezra Ehrenkrantz, was formed at Stanford's Educational Facilities Laboratories to develop standardized building components designed specifically for school construction. Thirteen California school districts and their architects were made partners in the program and an analysis of their requirements was made by the team and its consultants and distilled into a manual of performance specifications.

Energetic industry participation in designing components to these specifications was assured by the fact that the 13 school districts involved had projected needs for 22 schools—a guaranteed market of $30 million for the manufacturers awarded the SCDS contract. Realizing, however, that more than just industry participation but also intra-industry cooperation was necessary, SCDS let it be known that the four individual component systems called for—structural, heating-ventilation-air conditioning, lighting-ceiling, and interior partitioning—were to be judged not on the lowest bid submitted for each but on the lowest "composite" bid. In effect, manufacturers in the four system areas were forced to collaborate, each integrating his components with these of the other three.

Inland Steel's structural system designed by architect Robertson Ward was awarded the SCDS contract. It is, as noted by Allan Temko in his article on page 8, "Ingenious . . . with its



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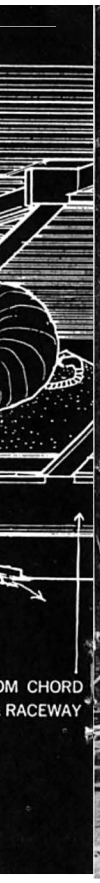
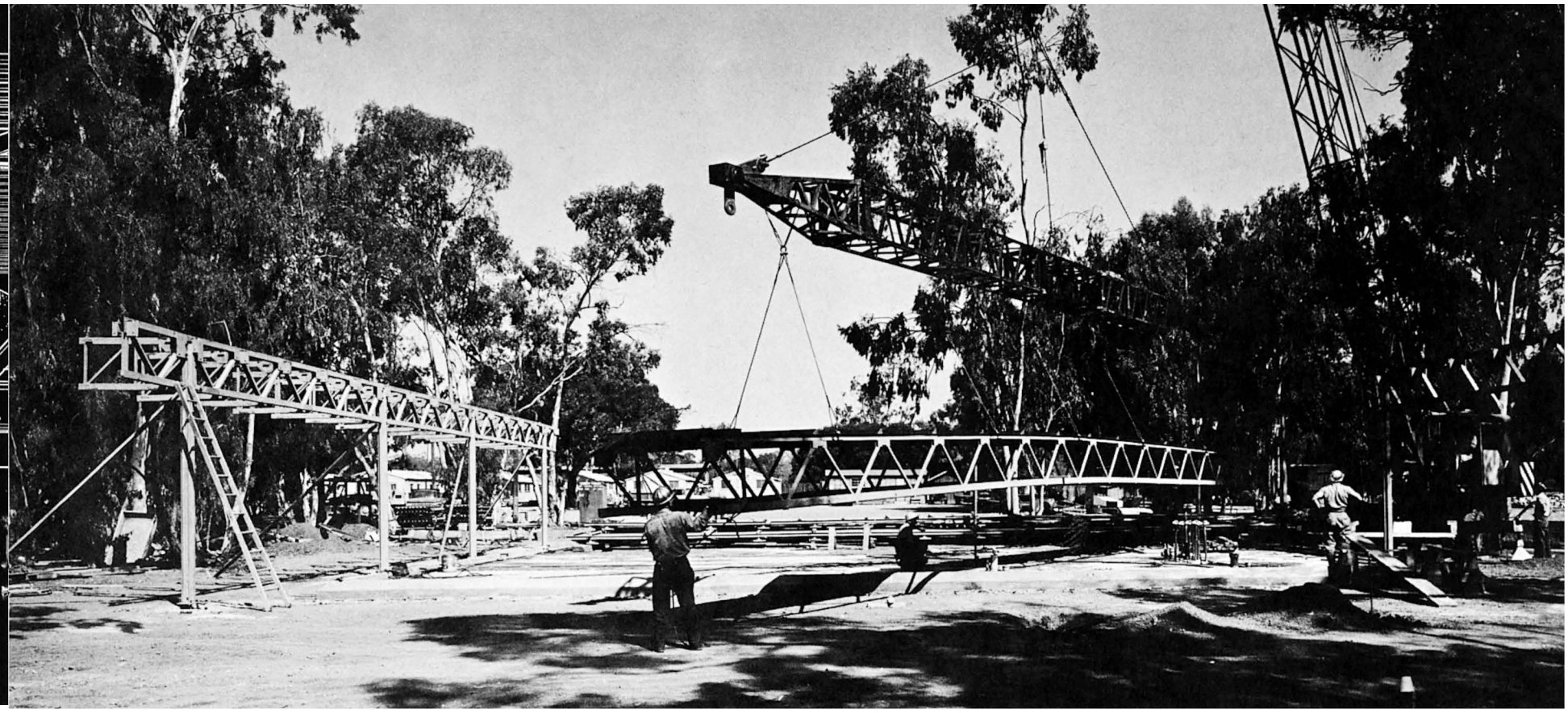
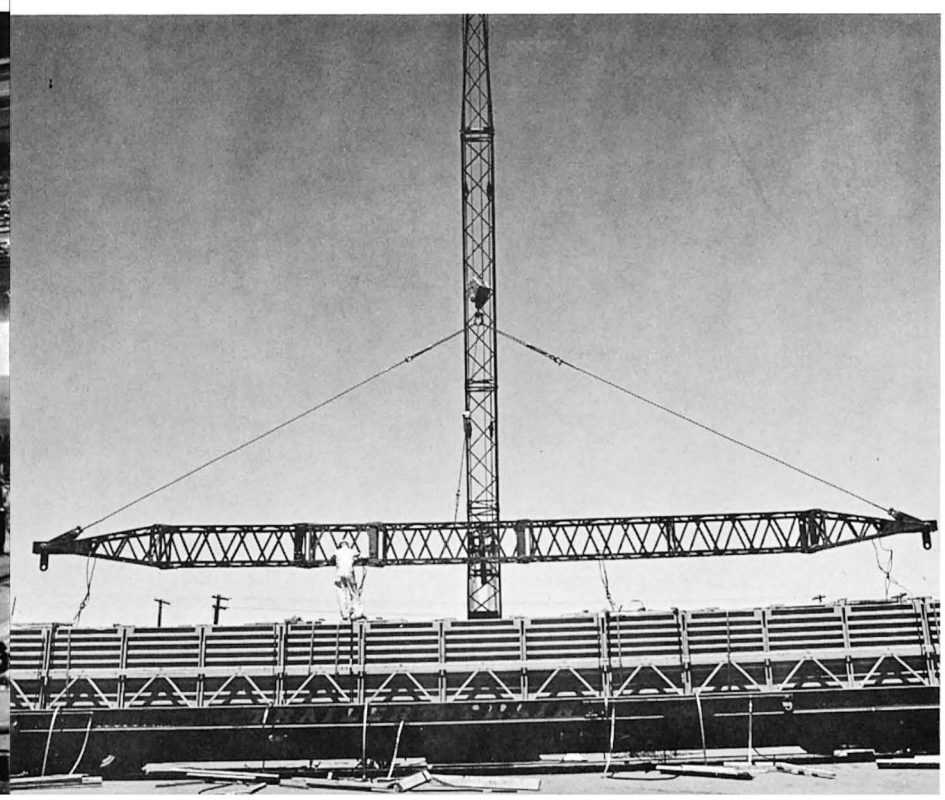




Photos by Rondal Partridge

Below folded truss-decks of 80′ x 80′ mock-up building are shown as shipped to Stanford from Milwaukee Inland Steel plant at left. A helicopter replaces crane, lowering Lennox 8′ x 21′ x 4′ heating and air-conditioning unit onto its roof mounting. Drawing is of the ceiling-roof structure which integrates lighting, service ducts and interior movable partitioning hung from the ceiling grid at 5′ centers.

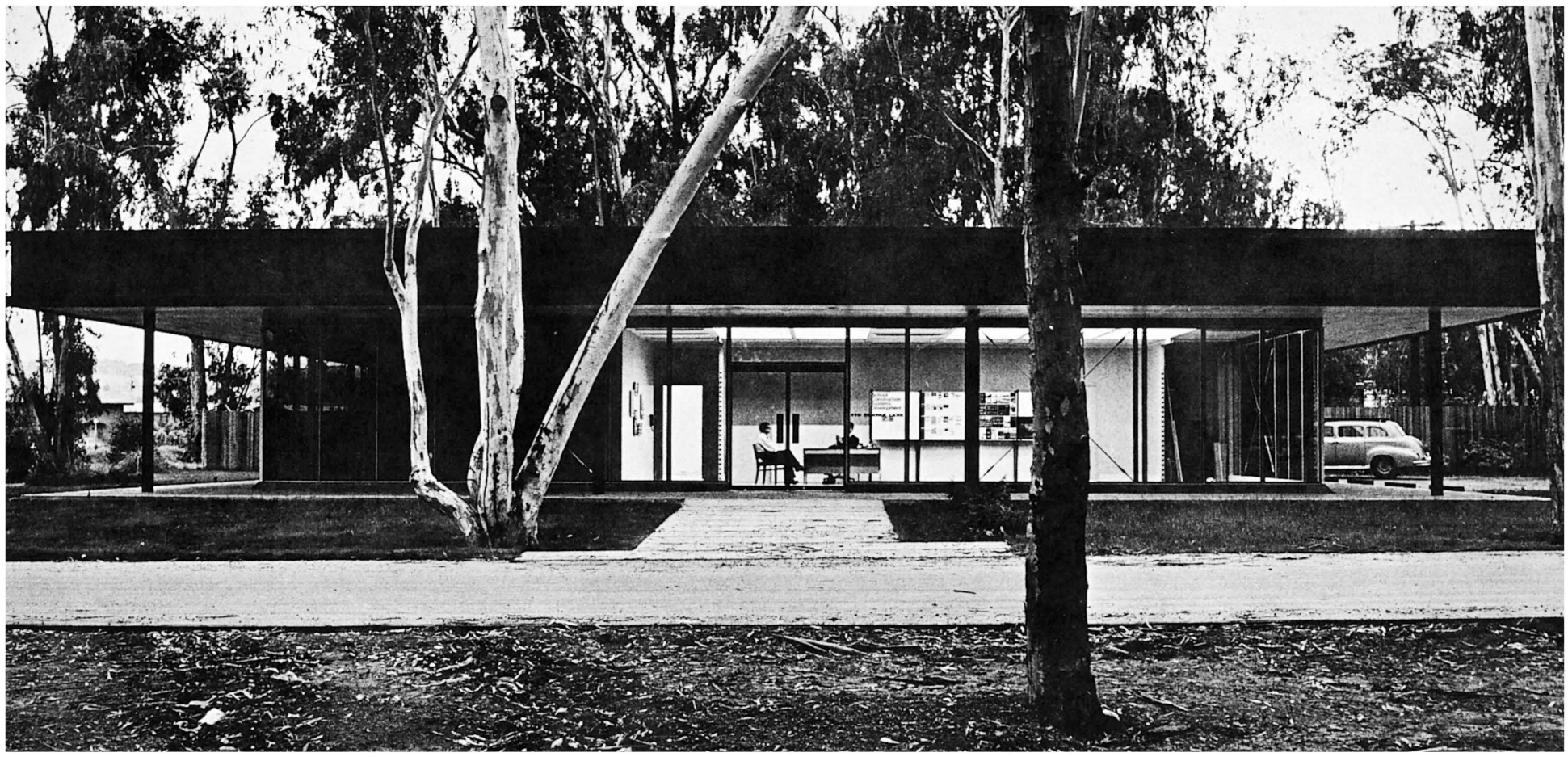


At left, hinged truss-decks are in place but still folded. After unfolding, the 10′-wide decks are welded to adjoining sections. Center left, workmen are installing lighting coffers which go into 3′ sandwich between roof deck and ceiling (center right and drawing on page 16) which also carries all service ducts.

remarkable lightweight folding truss which can be delivered by flatcar" and integrates the mechanical, partition and lighting-ceiling (also by Inland) systems.

In addition to the several schools already built of the SCDS components (see the following pages), Lockeed Aircraft is currently constructing a plant out of Inland's system. And other of the manufacturers who participated in the program but failed to win the SCDS contract are reportedly marketing their components with some success.

Architect William Blurock, whose practice is heavily weighted to schools and who has built several using the SCDS components, is unreserved in his praise of the program and its significant success in bringing about an entente among designer, producer, government, school officials and boards. He is, however, more cautious in his praise of the components system itself. In fact, he says, "the word 'system' is a



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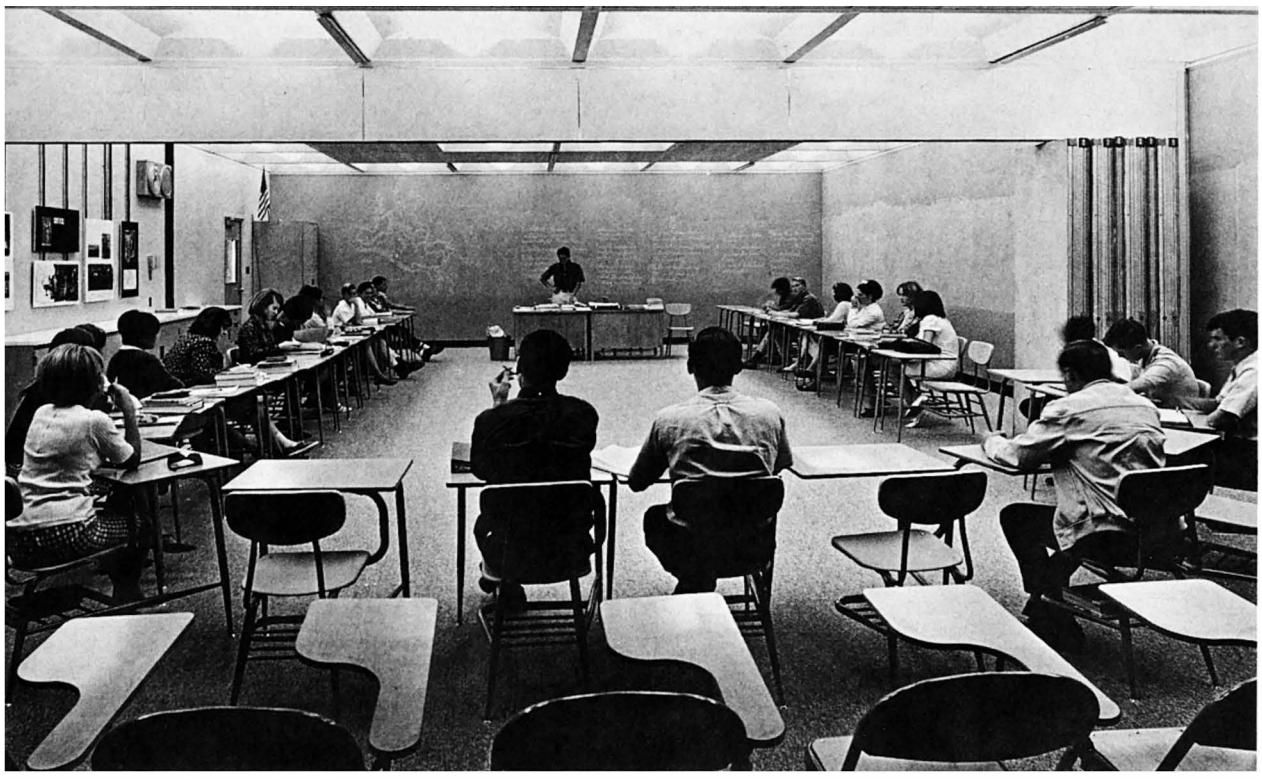
misnomer. It's still a series of parts to assemble."

The Inland system repeats very well, according to Blurock, and affords a high degree of flexibility of campus complexes and, in conjunction with the demountable partitioning, of the planning and rearranging of individual buildings. On the other hand, he finds the integrated roof/air conditioning/lighting-ceiling combination too confining.

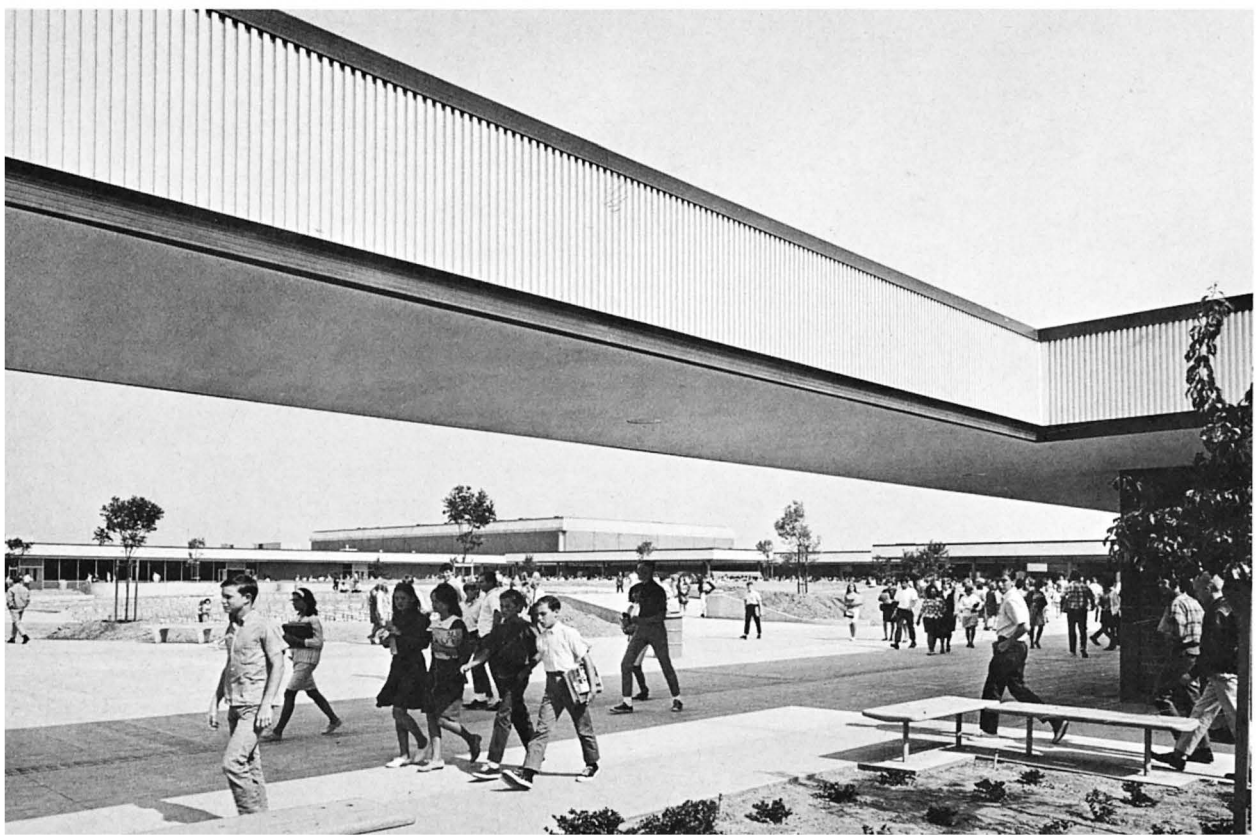
It is the opinion, then, of the architect who has had the most experience with the components independent of the SCDS program, that while the immediate result was perhaps "disappointingly conventional" in its approach to construction, the achievements in group effort and planning (and performance specifications written to architect standards) are a huge step forward and that the program should be continued by all means and similar programs initiated in other areas of building.

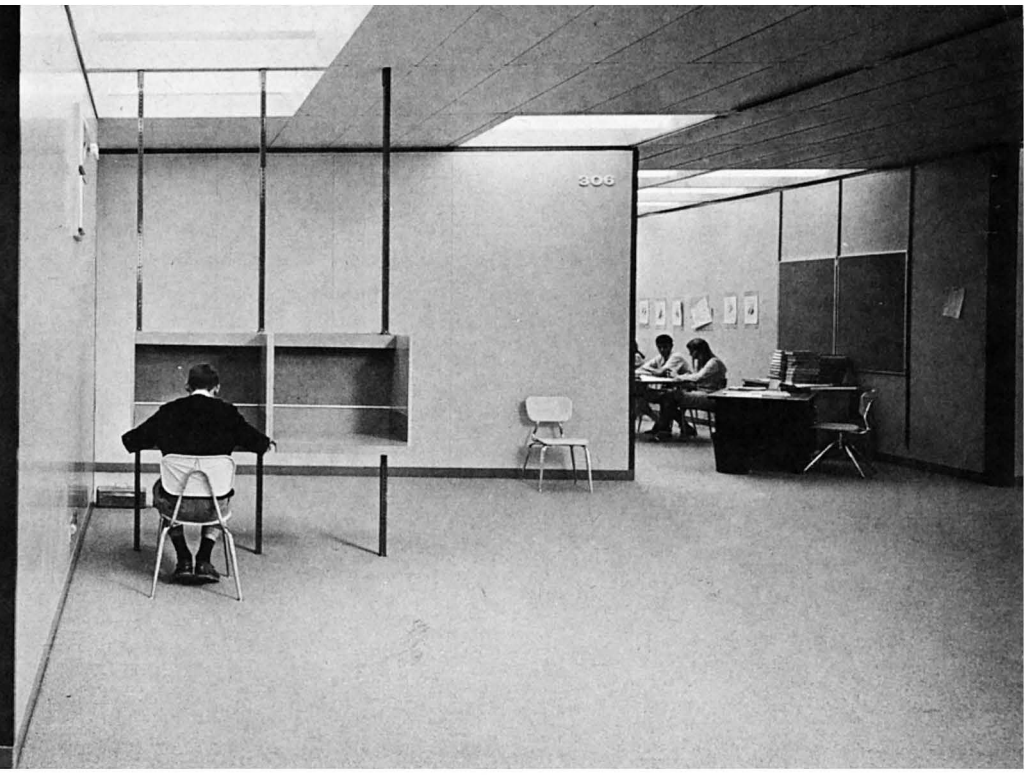
Photos on this page are of the De Laveaga Elementary School in Santa Cruz by Leefe & Ehrenkrantz. Demountable partitions are composed of independently movable, interchangeable 2' panels which clip to both sides of steel studs fitted into metal track at floor and ceiling.



Fountain Valley High School in Huntington Beach (left) is by Neptune & Thomas. Classroom photo shows open lighting coffers which by varying number and position of strip fixtures give direct or semi-direct lighting. Flat vinyl diffusers can be used to create luminous ceiling. Operable panel wall by Western Sky Industries, open between two classrooms, is also demountable and can be moved to new locations on the 5′ grid as needed. Support points for exterior wall frame are provided in the roof structure. Shear walls can be located at any 5′ module line in either direction where seismic conditions require.

Below and top right is El Dorado High in Placentia, Calif., by W. E. Blurock & Associates. Sonora High in Fullerton, Calif., (right center and bottom) is also by Blurock.





ARCHITECTURE IN THE INDUSTRIAL AGE BY **K. LONBERG-HOLM**

Our increased understanding of social morphology and human affinities to time, space, and matter has not yet been methodically applied to the building problem. It is generally assumed that this problem will be able to solve itself, left to the self-interests of business, politics, real estate and owner.

The result is discouragingly evident. Our cities are impressive only in mere size of amorphous form. We have progressed mechanically and structurally; but our housing is expensive and inadequate, our architecture an escape from reality. Only purely utilitarian structures show unity of purpose, function and form.

The malady is recognized by the architectural profession, but the true cause is not understood. Consequently the architect resorts to the most immediate expedients and offers superficial remedies in "modernized" architecture and in increased architectural service.

An unsatisfactory solution of a given problem may be caused by an unclear or contradictory program, inadequate instruments and working methods, or both. More architecture cannot change the inorganic structure of our cities. The solution lies in appropriate city-planning; but a new conception of city-planning based on a clearer understanding of the organic functions of a community must lead to a reorganization of the tools and agencies engaged in the building process.

The building activity of a human society is a continuous space-organizing process, determined by the cosmic orientation of the social group—its religion or philosophy, and its space-time conception. The continuous change in the social order is accompanied by a corresponding change of the tools and methods employed. Arts and crafts become science and industry. An organic social structure is possible only when social functions and building process are guided by related fundamental laws.

Science has changed man's relation to nature and to society. The individual and society alike are forced to find a new balance, a new synthesis. Relations to a visible world have become relations to invisible energy. We have discovered the close relations between phenomena apparently unrelated and gained a new understanding of the growth of a civilization. Illusions have been destroyed. New needs exist, particularly the necessity for a reorganization of life and society to deal with the new reality. We enjoy form as a demonstration of function, and have extended and deepened our conception of beauty. We are sensitive to new qualities.

Matter, light and color we conceive as visible energy that can be measured and harnessed. Ornament and decoration have lost their value as symbols and have become atavistic exhibitions. We have discovered new relations between our physical surroundings and our psychological reactions. Aesthetics has become psychology; time, a new dimension.

The speed of mechnical transportation has been increased; consequently our sense of distance, our spatial scale, has been altered. The illusion of matter as a solid has been destroyed. Our space is an open space, a space we conquer and penetrate—not a space we close off. Instead of cities closed in by fortifications we have the metropolitan region existing as a sum of relations between individual units; instead of solid stone construction, metal tubes and trusses; instead of pressure, tension; instead of steam, electricity.

The architectural ideology based on aesthetics has lost its validity in the industrial society. The conception of architecture as a fine art in contradistinction to the creations of science and technique, and the resulting conception of form as a value in itself, has brought the architect to exhibit an instinctive antipathy toward the industrial society's mass-production and toward its negation of arbitrary and absolute form, mass, gravity, and of buildings as monuments and media for self-expression.

For him the law of economy applied to time, space, and form—types and norms—becomes restrictive instead of creative. Afflicted with this antipathy toward his actual environment and with a related desire to beautify, i.e., escape the new reality, he deals with form instead of space, ignoring the form-creative process. His form is consequently insignificant and amorphous. Design is limited to the surface, and deteriorates to mere decoration in his concessions to the fleeting fads of the hour.

The victim of aesthetic inhibitions, the architect has lost his leadership. From a professional man with a professional ethics he has become a business man subject to the whims of the buyer.

The progressive architect acutely realizes that his problem means ultimately the negation of his profession. He has no power to meet his dilemma through his architectural work. As an individual businessman he cannot afford the research work necessary for the proper execution of his ideas; moreover, he is confronted by the gulf which separates him from a client unsympathetic toward an experiment at his expense. The rare exceptions from this do not alter the general aspect of the situation. And professional organizations have the problem's solution still less within their command since they are primarily interested in the protection of professional interests.

Collective problems require collective thinking and collective work. Industrial organizations are logical instruments for an industrial age. They function rationally in several distinct divisions, namely, scientific research; social contact or sale, dependent upon the establishment of a basis of understanding between the laboratory and the consumer; production based on modern machinery and economy, the striving for types and norms, the constant elimination of superfluous matter and obsolete form, thereby attaining the material achievements of our day and simultaneously creating a new plastic reality. We must learn to apply these modes of an industrial age to the building problem.

Our cities and buildings are organized space, space-machines to facilitate the free function of human and social needs: working, playing, mating, resting, thinking, and creating needs and human relations seen in the light of contemporary knowledge. These spatial structures must be flexible and always conform to the functions of life. They have no independent value in themselves. The plastic elements—material, light, and color—should be organized in accordance with social, physical and psychological determinants. The utilitarian factory differs from the living quarters and the emotional stage-setting only in the intended function. The creative process is the same.

Acknowledging the full scope of its implications, it must be admitted that this is a complex social problem. Its successful solution must depend upon the collective efforts of:

research,
planning,

Building industries, specialized according to types.

The organization of progressive forces in architecture, engineering, industry, and sociology would be the logical procedure for a conscious transition from the present division of work to the inevitable future. The functions of this organization would be:

To act as a clearing house for individual research,

To create an economically independent research institute.

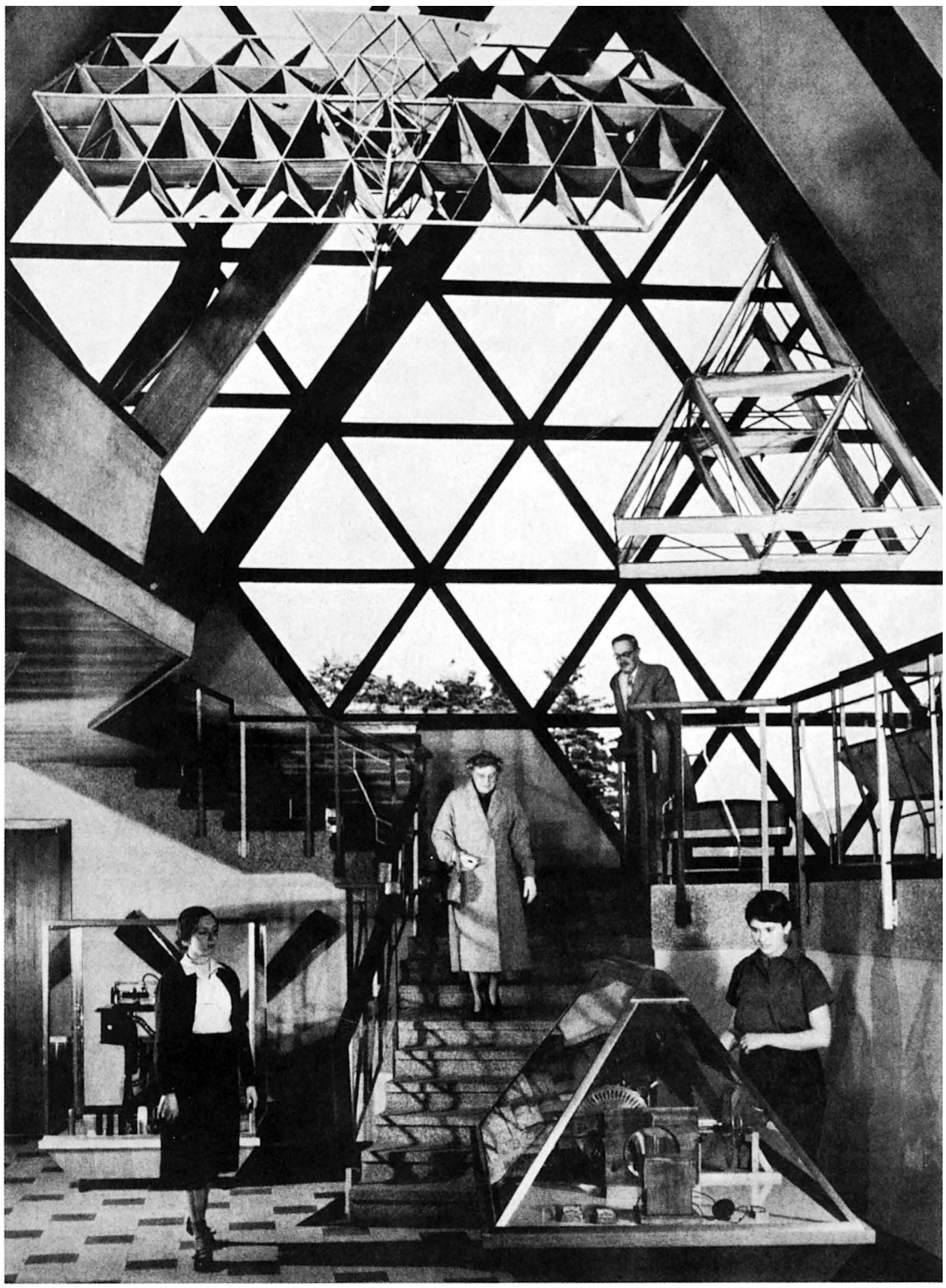
The research work-analysis of problem, the determination and definition of types and norms, collection and organization of material —would provide the basic factors for:

The public instruction—the use of contemporary publicity instruments to create a new attitude in the public.

An experimental school—to develop new builders.

September 1929

Born and educated in Denmark, K. Lonberg-Holm came to the U.S. in 1923. He wrote the above article for Architectural Record *which he reports rejected it as too controversial, though the magazine put him on its staff. The article was also recently published in the monthly bulletin of the Michigan Society of Architects with the comment, "His 37-year-old article reminds us . . . of the very slow progress that has been made in developing an architecture suited to our technological capabilities."*



Above is Bell Museum near his home at Baddock, Nova Scotia. Photo by Willard R. Culver, courtesy and © National Geographic.

SPACE FRAME STRUCTURES

The space frame has long been a beam in the eyes of the research architect and engineer but a mote in those of the builder and his architect, despite the remarkable revelations of its possibilities by the inspired work of Wachsmann and others in the 30s and 40s.

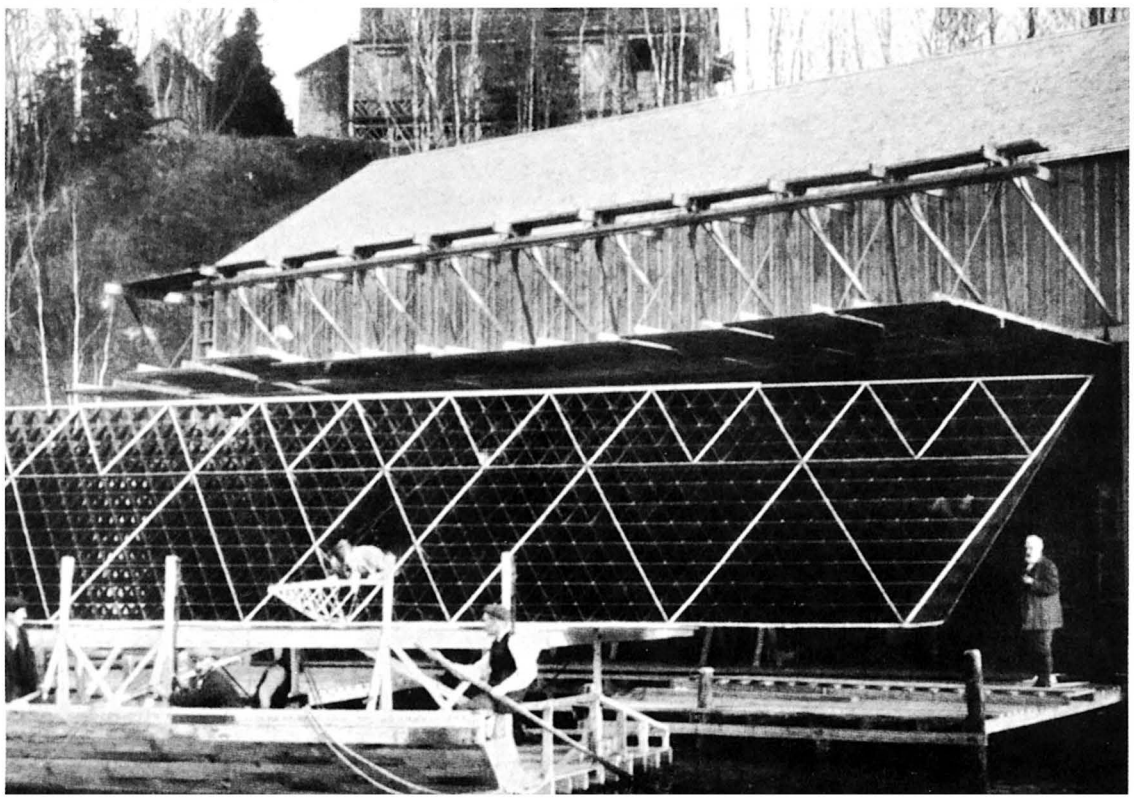
The photographs on this and the following page span almost 65 years and indicate that we have come full circle from Alexander Graham Bell's experiments with the tetrahedral space cell in kites published in 1903 by *National Geographic* to the 1966 Deltomobile toy of D.G. Emmerich and the $3 million fun house at EXPO 67, "Gyrotron" designed by Sean Kenny (the structure is by architect and engineer Boyd Auger).

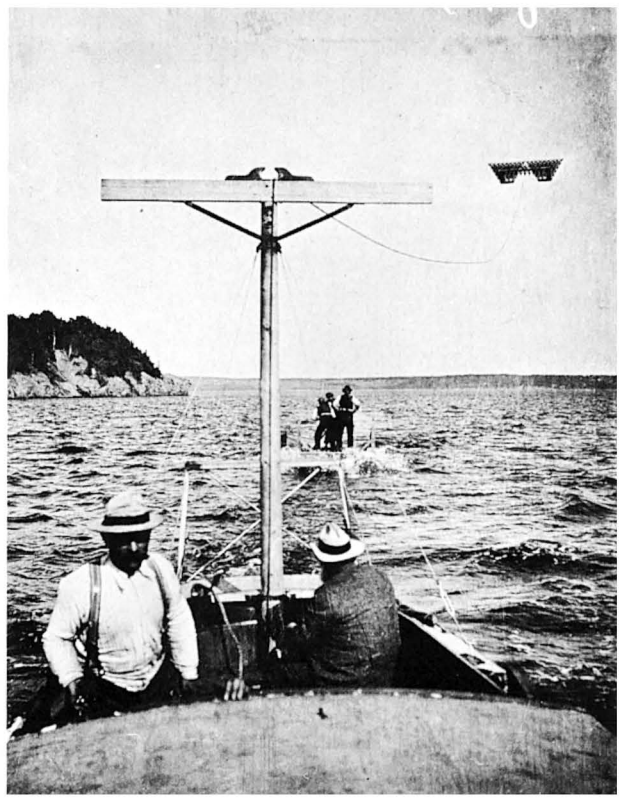
In the *National Geographic* article, Bell wrote of the space frame, "It is applicable to any kind of structure whatever in which it is desirable to combine the qualities of strength and lightness . . . we can build structures of all sorts out of tetrahedral frames, and the structures can be so formed as to possess the same qualities of strength and lightness which are characteristic of the individual cells."

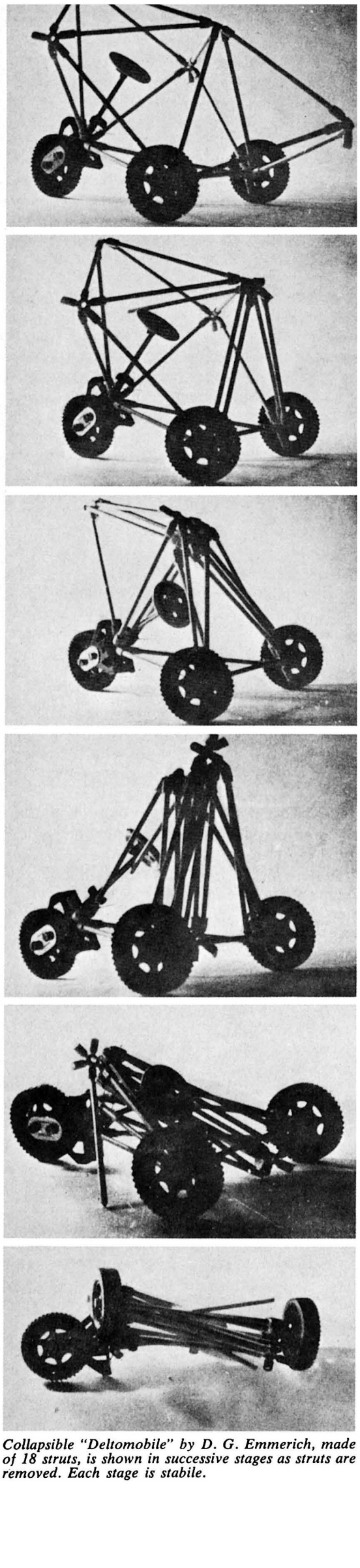
At the time he was experimenting with the "tetrahedral principle in kite structure," Bell had already built a house, a framework for a giant windbreak and several boats out of the same elements. The 80′ tower (next page) was erected in 1907 to demonstrate the tetrahedron's strength.

Analysis of the Gyrotron, which would have required an estimated 30,000 man lifetimes of hand computation, was completed in two hours by high speed computer. The advent of the computer has made the space frame a serious subject of structural research once again. What use will be made of that research is another subject.

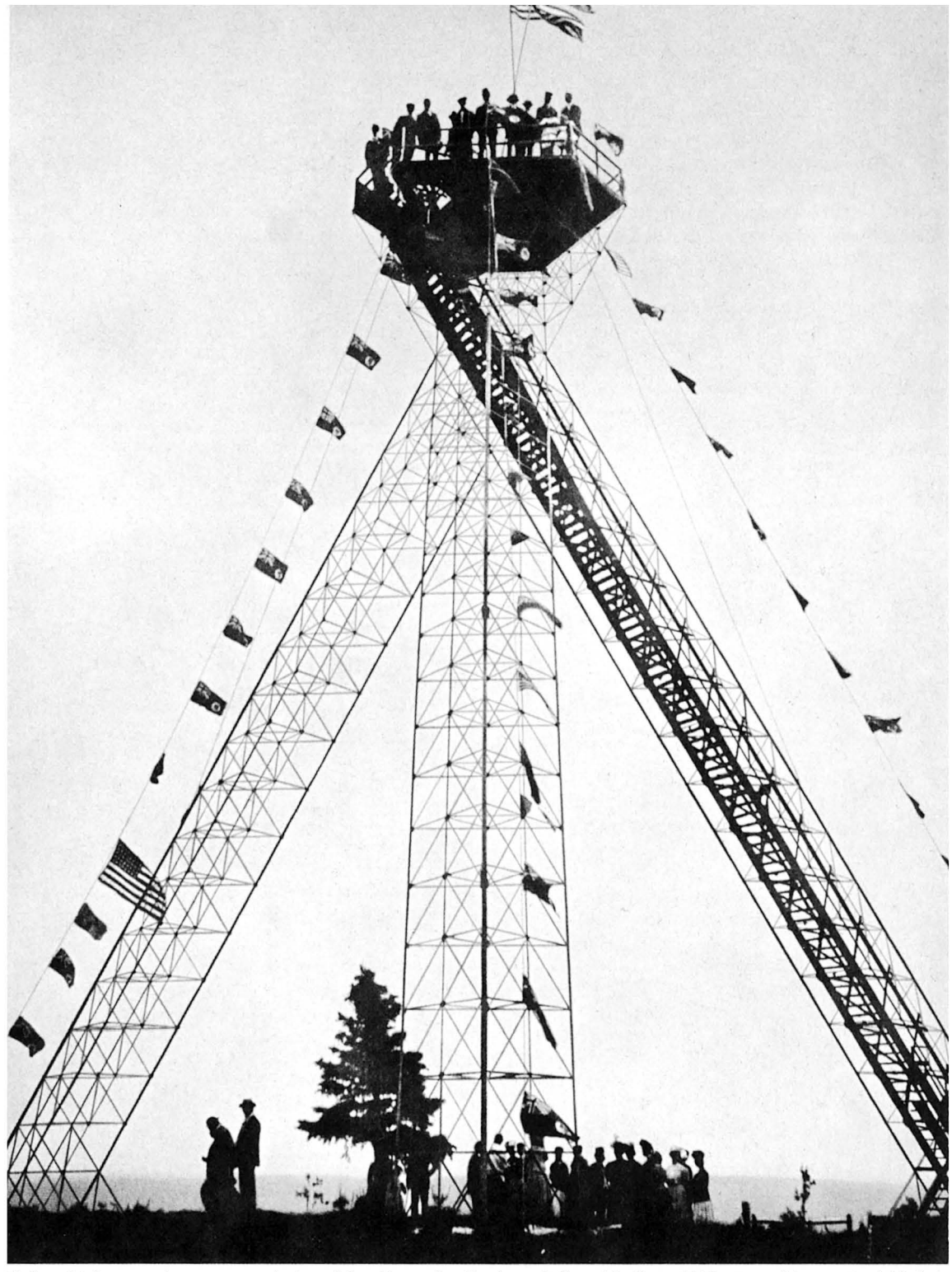
Giant multi-cellular kite (left) designed to carry a man shown at right during a 1907 tow test (without passenger). Photos by John A. D. McCurdy, courtesy and © National Geographic.



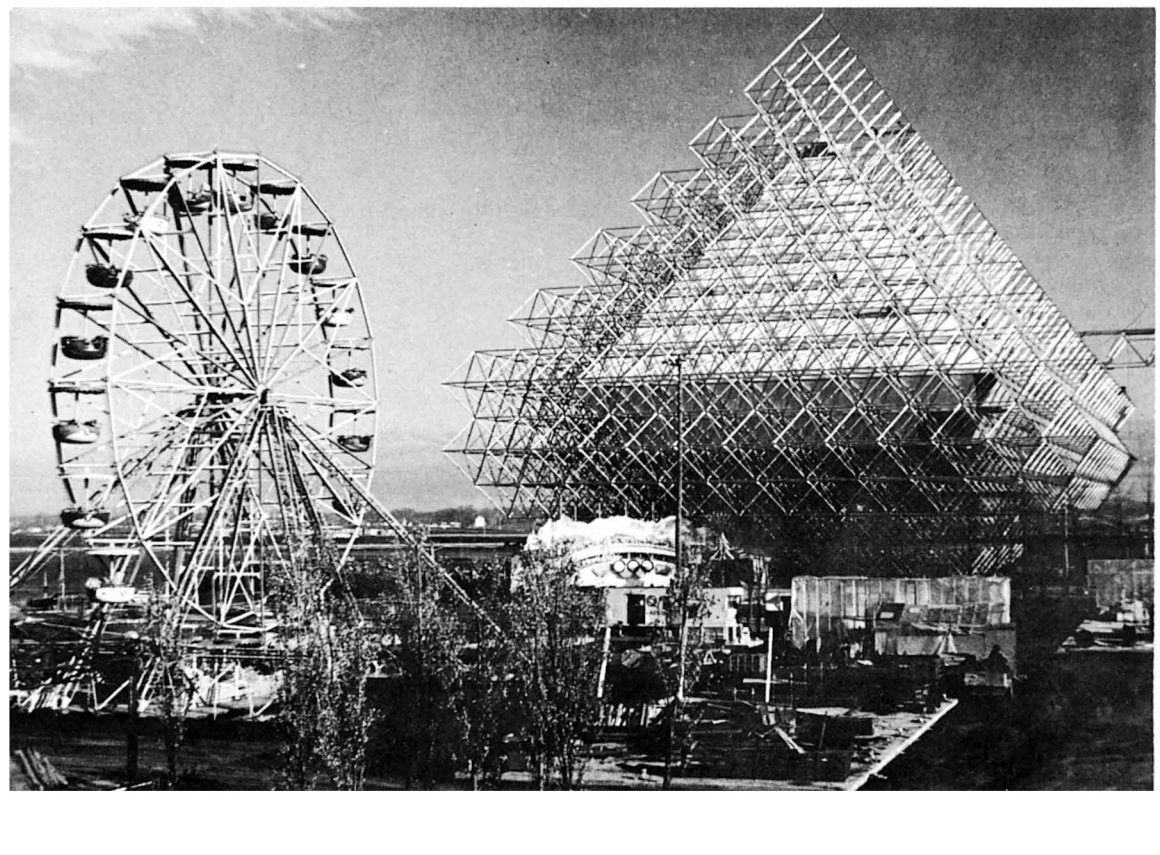




Collapsible "Deltomobile" by D. G. Emmerich, made of 18 struts, is shown in successive stages as struts are removed. Each stage is stabile.



80-foot high space frame tower designed by Alexander Graham Bell and built in 1907. Assembly required 10 days. Photo by John A. D. McCurdy, © Bell Family. Below is the $3 million Gyrotron pyramid at EXPO 67 fun zone.



DYNAMICS IN ARCHITECTURE
BY **PETER DAVID NAIRN**

The supreme discovery of twentieth century physics has been the equation $E = MC^2$. C, the speed of light being a constant, we see that energy is proportional to mass. This discovery has introduced the possibility of unlimited sources of energy, as limitless as the supply of any of our most common building materials. I would like to suggest that a potential analogy exists in the field of architecture. Can today's possibility of using energy in our structures, through movement, be related to historic uses of mass? Is there a further relation when one considers the amount of energy originally required to form such examples of architectural mass? Is there, in our energy potential so recently discovered, the as yet unrealized building "material," the new architectural dimension of our century? Considering the state of our contemporary technology, architects can realistically explore the fantastic possibilities of moving planes, changing spaces, movement of parts of structures and a myriad of other suggestions, all employing energy through movement. No longer will space have to be truly static with the only movement made relative to it, made by man. It seems incongruous that in our society, with the ever increasing importance of movement in our daily lives, whether by plane, train, boat, car, elevator or escalator, that the significant possibilities of using movement in our buildings to serve our purposes and for our delight has not been suggested or investigated.

Apart from buildings that literally move, such as tents, the uses of movement in buildings, virtually up to the twentieth century, have been confined to windows and doors and variations thereof. The large number of examples where movement is used in buildings today, such as elevators, escalators, moving partitions, sliding glass doors and operable skylights are developments of this century. In addition to these examples, where movement is only a detail of the structure, there are mobile homes, restaurants that rotate and sections of stadium roofs that revolve. It would seem that all these examples of movement in architecture, the use of energy, have evolved or were developed to satisfy a particular need and were not the logical outgrowth of investigations into the rational use of movement as applied to the needs of a society. The use of movement in architecture has remained the exclusive prerogative of manufacturers, because items that move require the close tolerances only possible to achieve in the factory. When the possibilities are so immense and exciting should our rate of progress in accepting movement in architecture be controlled by the rate at which manufacturers favor us with their new devices? If the introduction of movement into architecture is going to be anything more than a proliferation of gadgets it must be studied by architects, behavioral scientists, psychologists and doctors in close cooperation with the various branches of industry that will be responsible for the execution of their ideas. With the conviction that the use of energy in the functioning of buildings through movement is inevitable in our society, I would like to suggest that the architectural profession, if it wishes to directly influence the future of building, rather than being the passive accomplice, must initiate and stimulate investigations along these lines in cooperation with industry.

What truly significant advances have architects made in their concepts of space in the last two thousand years? Do they not take for granted the same traditional limitations that until this century were entirely realistic? Could movement be considered the fourth dimension of architecture? Could movement now be considered the only reasonable interpretation of the expression "Organic Architecture" rather than the emulation of nature? Is it possible for thousands of people living in identical structures to significantly vary their environment? To recognize the possibilities of movement in furnishing delight, we already have the many examples of the amusement park, one of the few instances where the fantastic possibilities of movement with relation to human environment have been quite fully investigated! I am not suggesting that our buildings, or parts thereof, gyrate and oscillate in similar fashion, but that we recognize the imagination behind these creations and the excitement and pleasure they bring, through movement of some kind. Must architecture be limited to solely stabile interpretations? If form is to follow function, can we continue to afford only a static interpretation of a moving process? Does the recent introduction of computer technology further suggest that we are coming even closer to the possibilities of movement in architecture, with the ability of computers to store a program of movement, to keep track of the movement of thousands of parts, and to investigate every possibility for movement that might have relevance? The infinite spatial possibilities of a structure whose component parts could could move in three dimensions is exciting, and, to judge from recent industrial accomplishments, perfectly possible.

Timid efforts that have partially recognized the value of movement are already in evidence. First, there is the example of mechanical parking systems. To date, these systems represent the beginning of the only sensible solution to the problem of handling automobiles that are not being used. Parking an automobile is analogous to placing material in an office file. Recently, with the aid of computer technology, this office chore has been automated. The problem with automobiles is the same—storage, memory and retrieval. Although the originators of mechanical parking systems had an excellent idea, their lack of imagination has led them to construct ordinary buildings with car elevators and human operators. Why must we think in terms of static storage spaces with single car capacity elevators, when we could design counter-balanced trays of cars that would move up and down, receiving and returning the cars at grade? In attacking this problem, besides opening our minds to the use of lighter structural materials and systems to lessen the weight of such moving structures, we must also pay attention to the space that lies below grade, and which represents the ideal storage space for such things as automobiles. To date, ingenious construction techniques such as lift slab, slip form and precasting, have lessened construction costs above grade, but have not been used below grade. We will have to investigate new methods for retaining this space below grade, because for many purposes it is just as valuable as any space above grade. In our age of increasing congestion and rising land costs, we can ill afford to neglect one half the potential spatial volume of a site. If the economics of the bowling business has made manual pin setting a thing of the past, surely in the near future, manual parking, whether by patron or attendant will also become a remembered annoyance; for is not the storing of automobiles in urban areas of far greater import than the setting of bowling pins? Present day garages are built to house both machines and human beings, and their construction must allow for all the health and safety requirements dictated by codes governing human occupancies; it is obviously wasteful, when human occupancy of such structures is entirely unnecessary. An even greater picture of waste is evident upon observation of the circulation space required to reach multi-story storage spaces, together with the needed volume for human circulation. The total volume of contemporary garages, when compared to the total volume of cars stored represents a fantastic ratio of wasted space.

The second example, that of the mobile home, recognizes the importance of movement in a different sense and is an important first step. Disregarding the aspect of movement, the mobile home also represents another important first in that it is the only successfully mass produced dwelling unit that this country has seen. At present we accept them with reservations, relegating them to certain less desirable areas of our communities. As yet the architectural and design professions have shown little interest in their design and construction, and it would appear that this attitude has been reciprocated by the industry. It is quite apparent to architects who have examined a mobile home that enormous improvements could be made in their design if cooperation between architects and the mobile home industry were to become a reality. One of the immediate prospects for the modest introduction of the idea of movement into architecture embodies some aspects of the mobile home. I visualize, in urban areas, essentially multi-storey structural grids equipped with elevators, stairs, areas of circulation and possibly public spaces as well, with electrical and plumbing services roughed in at certain modular coordinates. Into this grid would be hoisted, by means of a permanent built-in system similar to devices used in washing multi-storey exteriors today, complete factory built office or dwelling units similar to mobile homes. These units would have to be built to certain dimensional standards for wide acceptance, and would be designed to be moved from city to city on wheels, on a train, or not inconceivably by air, either by plane or helicopter. These factory manufactured dwelling or office units would be non-structural shells and would have readily accessible connections for all the services; having been raised to a particular floor, they would be rolled or slid into place. It is not impossible to imagine people moving from the heart of San Francisco to the center of New York or Miami Beach without packing more than an overnight bag. All their furniture, clothes, furnishings and even groceries on the shelf and in the refrigerator would remain in their apartment and would be moved safely, everything being kept in place by possibly using large inflatable plastic bags. The expense of such a move, I feel sure, would be competitive with today's operations when all the handling of separate items is considered. Move-

ment of one's living facilities abroad with a minimum of fuss is another possibility. This concept of apartment living, without the problems of buying, selling or renting, would really make the freedom to move something to be regarded with pleasure rather than dread.

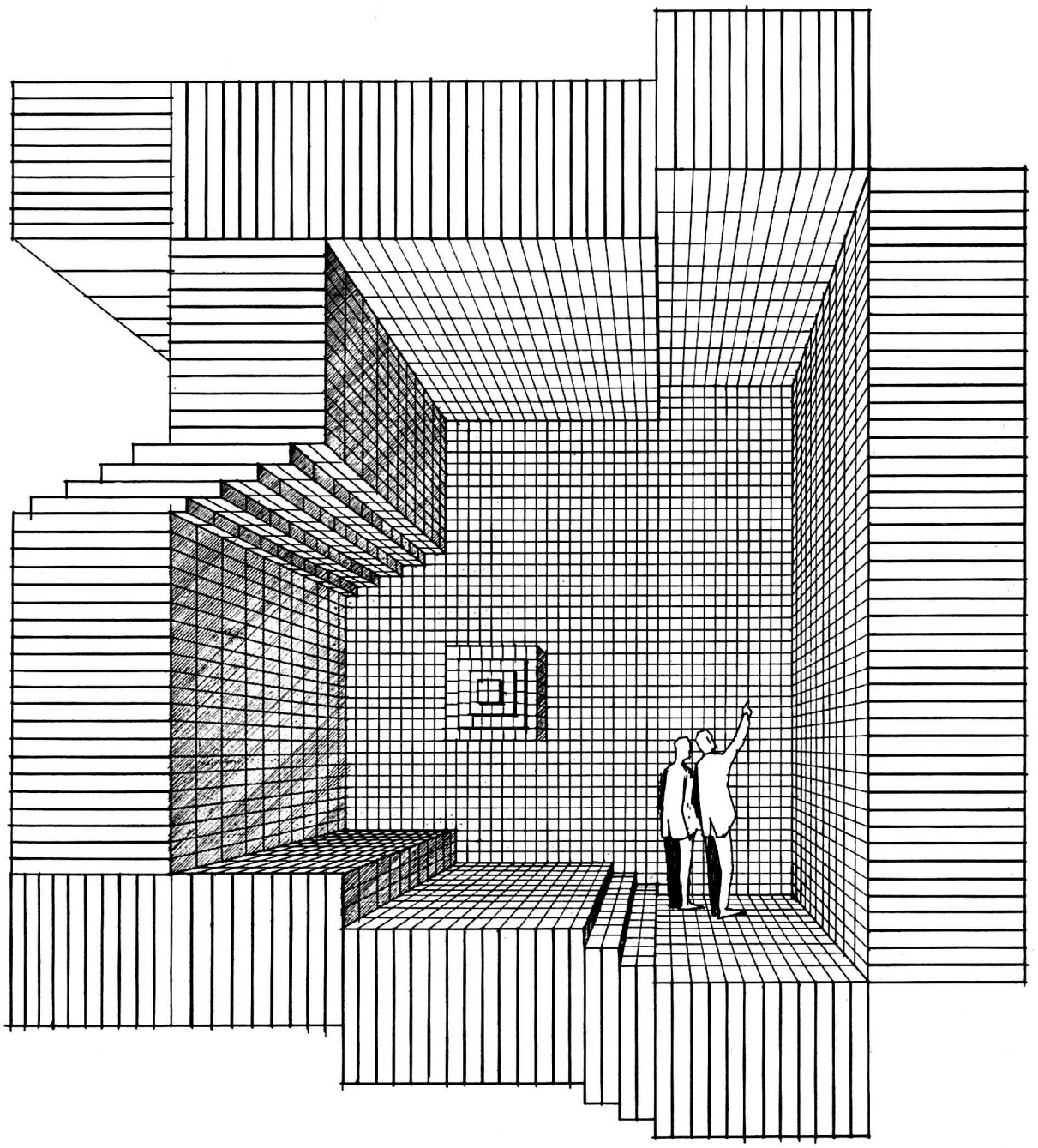
I have tried to describe the promise of movement, to show how it has been creeping into architecture uncontrolled, and to suggest some really possible projects. I feel that such projects will eventually, inevitably, with or without the assistance of the architectural profession, become realities. The profession, I feel, will be faced with a choice. It will either choose to abdicate its position as leading spatial arbiter, relinquishing an ever growing concept, movement in architecture, to industrial designers, or it will have to choose to broaden its position, reexamine the new materials, devices, techniques and discoveries of this century, enter the factory and work and cooperate with a far greater number of experts than ever before. It is hard to imagine such an embrace with industry when at this time it would seem that dissatisfaction with machine and factory built appearances has led to increasing interest in architecture employing the massive and sculptural qualities of concrete. Can we afford this subjective dalliance with such weighty materials of the past whose traditional virtues have been matched by countless materials of this century? Does this suggestion of a style enjoy its popularity for lack of a new contemporary challenge whose one prerequisite would be lightness? Earlier in this century, an architect, Le Corbusier, said, "A house is a machine for living." But how can architects, who have been aware of this statement for years, continue to overlook the only factor that differentiates a series of parts from a machine—movement? Art has influenced some aspects of architecture, yet we have neglected the suggestion of the mobile, an accepted expression of our age. I believe that our society is very definitely committed to the ever increasing use of industrial products and labor saving devices, and also that it is receptive to suggestions of flexibility and variety in its environment. Considering also the constant pressures forcing more economical use of space and more economical enclosure of space, it is inevitable that a growing proportion of construction will be done in the factory. It is also inevitable, I feel, that this factory based construction will enable architects to use movement; to explore its possibilities in relation to flexibility and variety of environment consistent with an economical use of space. It promises the world an exciting new architecture of constantly changing impressions, in which stabile forms of visual interest would have even greater impact, a new architecture that perhaps would be the only true expression of our age.

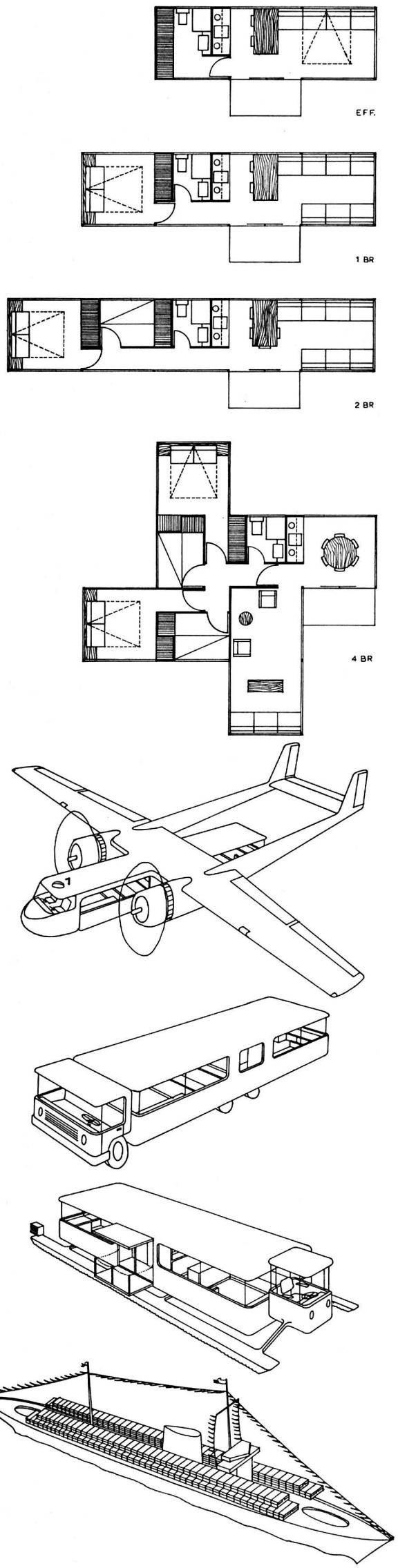
An immediate problem associated with any consideration of dynamics in architecture is the representation for both design appreciation and communication of spatial change-modulation, contraction, expansion and "explosion." The presently accepted means used for three dimensional study are grossly inadequate; they would seem to be inadequate even in the consideration of static space, since architects so often express surprise upon experiencing their constructed spaces. It is not uncommon for them to wish to make changes, after the space or spaces are laboriously realized and it is economically too late. These changes can seem so obvious in three dimensional full scale realization and yet can be so elusive in initial design stages when they can easily get lost in our accepted design procedures where we are dealing with fragmented two dimensional representation.

As shown in the sketch, the proposed space simulator has a cube shaped frame. In its position of repose, each of the six interior surfaces of the cube consist of many ends of square, interlocked tubes. Each tube would be capable of controlled, graduated movement, either in or out, with respect to the fixed frame. It would be possible, from two dimensional drawings of plans, sections and elevations to prepare a business machine card that when inserted into a computer linked to the space simulator would cause its "two dimensional points" (the tube ends) and their shafts to represent three dimensional space from the two dimensional drawings. The scale of the space would of course depend on the size of the simulator. If the simulator were relatively small, additional scaled insertions would have to be made to present a valid scene. In representing certain surfaces the space simulator would essentially be giving finite dimensions to a group of non-dimensional points. Curved surfaces can be reasonably approximated since they can be considered as a group of relatively small planes (the tube ends). The accuracy of representation of curved surfaces would essentially be a function of relative size of the tube ends to the size of the cube frame.

Spatial observation could be made either from inside the space simulator, if it were large enough, or by means of optical projection from within. It could be an extremely useful tool in the design process enabling one to view a variety of spatial schemes accurately in three dimensions and in very rapid succession. It would also be possible to capture "final" spaces and spaces in dynamic evolution at any particular moment in time photographically. It is conceivable that such a device might even be controlled in a manner that would make three dimensional sketching a reality.

If we are ever to investigate and experiment with dynamics in architecture, the assistance of a device such as the one described, or something similar, will be essential. It would seem illogical to turn to the contemporary technological scene for construction techniques alone without also considering what help it might offer for our rather archaic ways of spatial conception and representation.





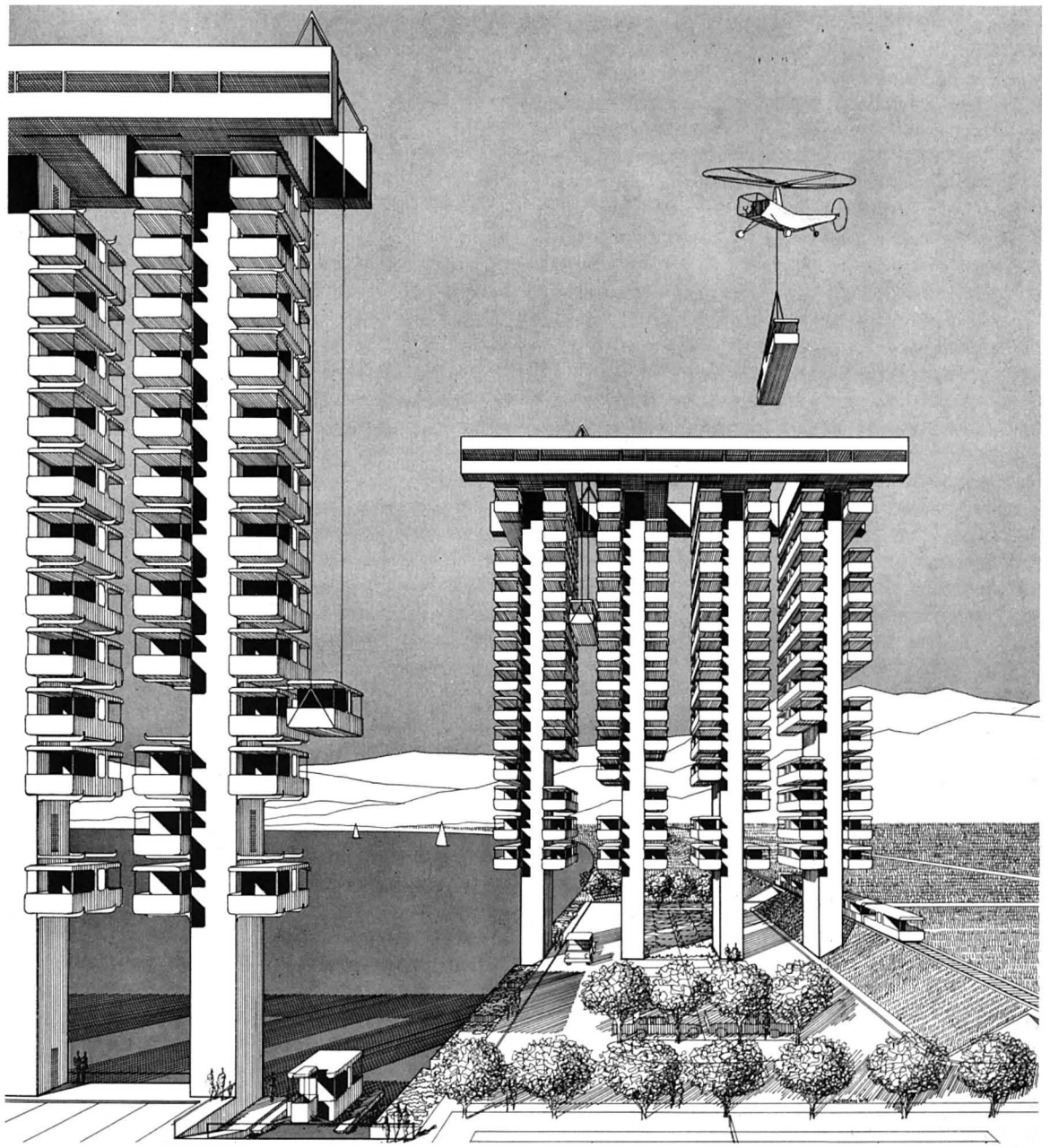
INTERPOD
WILLIAM MORGAN, ARCHITECT

The ideas expressed by Peter Nairn about a mobile architecture to match the restless—if not yet rootless—mobility of our society physically and otherwise are becoming an increasingly widespread preoccupation with designers here and abroad. Even in the realm of the hypothetical, however, American architects have difficulty freeing themselves from their thralldom to manufacturers and the construction industry. There is no counterpart here, for example, to the Archigram group, some of whose members seem able to move easily from work of the utmost practicality and sobriety through mod and Twiggy drive-in, plug-in structures to space age fantasies of Wellsian proportions.

"Interpod" by Florida architect William Morgan is a low-cost mass-produced housing system which is also mobile. Basic units are composed of cells which can be joined together in various configurations suited to needs and placed in the landscape singly, grouped horizontally or set in vertical racks.

The typical pod contains a series of 8′ x 8′ x 8′ cells constructed of an aluminum outer shell which is separated from its inner plywood shell by 2″ of plastic foam insulation. The carpeted living room contains built in couches separated from the food center by a dining table and low wall housing electronic controls for communications, television and illumination. Two weeks' requirements of food are stored compactly in minimum space, similar to the food centers of large jet passenger aircraft today. A bath separates living and sleeping areas. Beds convert to couches for sitting room use during the daytime. Entry is gained from a porch through sliding doors or through doors at the ends. Windows may be adjusted for any degree or transparency, translucency or opacity by a control dial which varies electric current across the glass, eliminating requirement for sun control devices or privacy screens. Temperature is controlled by thermocouple plates in cell ceilings.

The mobility of the pod is an obvious advantage for vacationing (e.g. it becomes a boat-deck stateroom aboard an oceanliner), recreation, travel of a family or group, apartments, dormitories, second houses, migratory labor, seasonal uses, slum clearance and urban renewal.



THE FUTURE—CAN WE FACE IT? THE ARCHITECTURAL IMPLICATION OF INDUSTRIALIZED BUILDING

BY **GUY ODDIE**

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Evangelical and fundamentalist, the Modern Movement of thirty years ago saw prefabrication as the instrument of an ideal. Responsive to the machine aesthetic and using Ford techniques of mass-production, it was to be the logical means of bringing machine-age benefits to a mass society. Before and since, however, the development of prefabrication on any significant scale has been due, not to architectural ideology, but to *force majeure*. Either there has been no technological alternative—as with the cast-iron frames of the great nineteenth-century glass-houses—or there has been an insurmountable shortage of building labour, as in the case of post-war houses and schools.

The search for lower costs or speedier erection is only an extension of these coupled motivations which, as modern societies pursue their goals of greater wealth and higher productivity, reinforce each other. Hitherto, at least in Britain, the emphasis has been on saving site labour; and although components have been factory-made the factories themselves have mechanized to a comparatively small extent. But men using machines can produce wealth more quickly: without machines human resources are under-utilized. Henceforth therefore, an increasing effort will be made to save labour in the factories as well as on the site, and prefabrication must be seen as part of an accelerating trend towards using methods of production which, in economists' jargon, are capital-intensive rather then labour-intensive. Together with associated forms of industrialized building it must now be regarded as the norm rather than the exception.

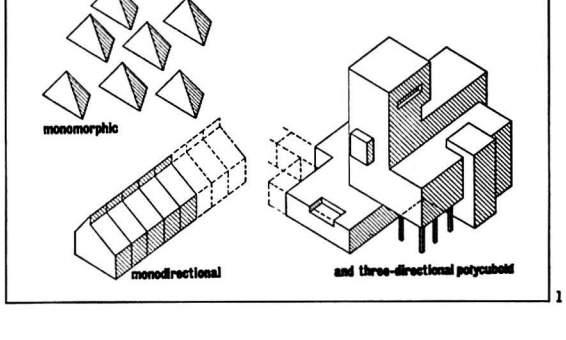
The situation can only be reversed by reversing the objectives of society, which seems unlikely to be deflected from its course. The prophetic logic of Gropius and Le Corbusier has been confirmed by the practical logic of events; yet the contribution of prefabrication and industrialized building towards an ideal twentieth-century environment has not been marked. Disenchanted by experience, we tend to turn our backs on what appears to be a desiccated, faceless future. But since heads in sand leave backsides vulnerable, a more penetrating examination of the architectural horizon is needed to see how events can be set on a more hopeful course. The recent publication of a history of British prefabrication compiled by R. B. White, an architect at the Building Research Station, affords the stimulus to do so.[1]

No detailed argument is needed for saying that capital-intensive methods of production thrive on repetition and languish without it. Thus is equally true of all industrialized construction whether light-and-dry produced off-site or wet-and-heavy produced on the site itself. No satisfactory explanation has ever been given for the high costs which killed prefabrication in the post-war housing programme, but Mr. White thinks it likely that insufficient repetition was a contributory factor. Between 1945 and 1948 the total number of prefabricated houses erected in Britain amounted to only 156,667. Eleven firms were producing eleven different designs and the greatest number produced to one design was 55,000. Volkswagen, by way of contrast, turn out about a million vehicles a year. In the post-war schools, prefabrication certainly saved site labour and erection time; but it showed no significant cost reduction until the CLASP consortium of school building authorities was formed to increase the size of purchasing orders and hence the degree of repetition.

The current volume of CLASP production stands at about $56,000 a year. Allowing (conservatively) and ex-works price of $840 per vehicle, Volkswagen production is fifteen times greater. Admittedly the comparison is specious—it takes no account of how often each component and assembly operation is repeated in either case or of how the total value of production compares with net annual value of the plant producing it. Nevertheless, the broad figures indicate how much further building must still go before the machine's greed and appetite for repetition can be satisfied. On the other hand it is precisely from horror of repetition that fears for the future stem. If 157,000 pre-fabs gave a dog a bad name, what would a million have done? Thus the key issue for our architectural future is how to satisfy the economic demands for repetition yet ensure that architectural values are established and maintained.

The repetition of standard components such as doors and windows does not in itself cause concern so much as repetition of a quite different order. For this other order of repetition a convenient and immediately descriptive term is difficult to find; it is the kind of repetition which occurs when enclosing elements such as walls and roofs are made up wholly of prefabricated or repetitive components. Because the lowest dimensional limit of components "off-the-peg" is appreciably greater than with components "tailor-made," there is a minimum volumetric increment by which the shape and size of such constructions may be altered. This kind of repetition, which may therefore be called *incremental,* is central to the effect made by prefabrication on visual values.

Three major degrees of incremental repetition can be discerned, the most primitive extreme of which is seen in the post-war 'pre-fab' houses. Repetition in their case, since the size and shape could not be changed at all, demanded repetition of the house itself, and it may therefore be described as *monomorphic*.[2] The familiar prefabricated greenhouse or shed consisting of identical bays or sections throughout its length typifies a second degree of incremental repetition, which is essentially linear or *mono-directional.* Finally there is the rarer kind of prefabrication, best illustrated by CLASP,[3] in which shape and size may be altered by increments of cuboids added to (or subtracted from) the height and width as well as the length of the building, (1). The word 'cuboid' needs emphasis since the large role that squared planning grids play in such construction tends to obscure the fact that plan shapes are not so much a series of equal squares as of different sized rectangles made up of equal squares while variability of roof and story height adds further volumetric complexity. This third degree of incremental repetition may therefore be called *three-directional polycuboid.* (Regrettably, any other expression is either less descriptive or even more cumbersome.) In contrast to these degrees of incremental repetition, pre-industrial individually dimensioned building can be called *polymorphic*. The dimensional choice is infinite, the volumetric increment subject to virtually no restriction on either size or shape.



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Even the most advanced degree of incremental repetition of which industrialized building is so far capable falls far short of full polymorphic potential. In practice, however, this potential has been often left untapped. Pre-industrialized building has, for example, many of its own cases of monomorphic repetition including Egyptian pyramids and Apulian *trulli*. Ribbon-developed (and later) suburban housing shows, too, that the worst aspects of such repetition are not confined to prefabrication. Whether monomorphic repetition is tolerable depends, in fact, entirely on how much there is. A Sahara covered with pyramids or trulli or Buckminster Fuller domes would look as much a desert as an endless suburb of monomorphic semi-s or aluminium bungalows. Mono-directional repetition also has illustrious antecedents, in the classical colonnade or the eighteenth-century street. Again tolerability relates to quantity, as by-law housing and the recent proliferation of tall blocks of offices and flats bear witness. Memories of Bloomsbury or Belgravia or Georgian Edinburgh may at first suggest that the tolerable quantity in this case is nevertheless greater. Further reflection, however shows that even where repetitive streets and squares are *basically* mono-directional, a strong polycuboid character is imposed, if only by the incidence of balconies and porches or the adjustment of roof and floor levels to changing contours.

Much value is also rightly attached to the angular subtleties by which mono-directional character is modified as the traditional street skirts a forgotten water course or hedge-marked boundary. These are subtleties denied to any architecture obeying a strict rectilinear convention, regardless of whether it is industrialized or not. At the same time, even where the architecture itself is rectilinear, the architectural relationships need not be so—note, for example, the relative positions of strictly rectilinear temples on the Athenian acropolis. However, where both architecture *and* inter relationships are rectilinear (as at the present time they tend to be) the tolerability of mono-morphic and mono-directional repetition is minimized and the need for a polycuboid character correspondingly increased. Thus while one form of repetition does not exclude the other, the development of monomorphic or mono-directional systems without parallel development of polycuboid systems might well justify pessimism.

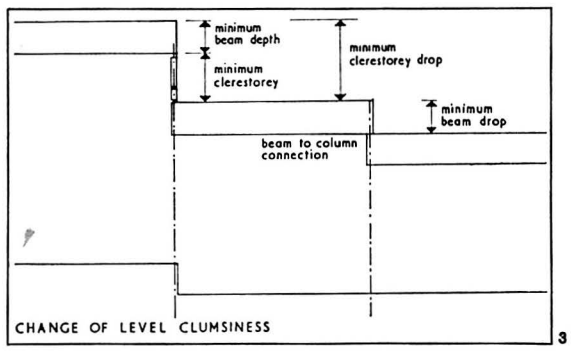
Industrialized building for multi-storey housing has focused interest and attention on systems which will be recognized as essentially mono-

2. The painted plaster, tile and stone of a Portuguese townscape. Photo by Geoffry Powell.

directional—vertical mostly, rather than horizontal, but mono-directional just the same; but for the architectural and visual future further development of three-directional polycuboid systems is central and vital in industrialized building. Seen from this viewpoint, what directions should further development take and what criteria should it try to meet?

Current developments are directed towards 'inter-changeability'; i.e. towards enabling manufacturers to make components to such dimensions and profile that they will fit any building system.[4] This, it is argued, will open both a wider market to the manufacturers and a wider choice to the designer. But is this kind of choice between a more extensive range of components, materials and textures, what visually the designer needs? Most admired townscapes are distinguished more by homogeneity than by diversity of material and texture. Assisi or Chipping Campden may be exceptional, but the painted plaster, tile and stone of the Portuguese townscape (2) represent the opposite extreme, of pleasurable diversity, beyond which lies the wild chaos of modern Oxford Street. Nor, functional purposes apart, is great variety needed in components: the photograph shows only three patterns of window and two patterns of door.

So far, present trends appear to open a prospect of embarrassing richness rather than restraint. Further analysis of the illustration, however, reveals three important choices which pre-industrial building offers and industrial building so far denies. The first of these, not easily evident at a casual glance, is a wider choice of *vertical* dimension. Few of the projections and recessions in this townscape would lie beyond the scope of a polycuboid system on a 40 in. grid; it will also be noticed that all openings are virtually the same width—possibly due to lintel restrictions; but, especially in the right hand half of the picture, both heads and sills are at



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differing heights. In short, vertical dimensional choice is greater than horizontal dimensional choice.

This example is only symptomatic of larger problems which arise when one cuboid abuts another. Because current polycuboid systems have been developed with schools primarily in mind, the vertical increment has been governed largely by the combined factors of roof-beam depth, ceiling height and useful depth of clerestory (3). Assuming, for argument, that floor, roof and clerestory depths are each 2 ft., a vertical difference of 4 ft. will occur between roof levels. Even where clerestories are not needed, the desirability of avoiding complicated beam-to-column junctions tends towards a minimum vertical increment of 2 ft.—an increment hardly conducive to subtlety of relationships with storey heights of generally 10 to 12 ft., and especially difficult when buildings have to be accommodated to gentle contours. Admittedly the vertical increment is often smaller than this in relation to sills and heads, but the roof level increments remain a serious problem whose importance grows the more a restricted dimensional system is adopted in the interests of interchangeability.

Two other devices so far denied to industrial building are closely linked (again in terms of visual value) with vertical incrementation and change of level. They are, quite simply, slopes and roofs. The boundary wall on the right of the Portuguese photograph can both literally and figuratively follow its inclinations. With prefabricated rectilinear panels it would have to follow the line of the black painted dado which so ingeniously and ingenuously effects a visual modulation between the close increments of the steps and the straight slope of the boundary wall. The lack of a device for handling slopes is a main defect of the covered ways built at the university of York (4). Pitched roofs over any but the simplest form of plan present technical problems of great magnitude, and no doubt there are plenty of leaks in the model townscape; but there is no denying their visual value in articulating the different building heights and in contributing by their rhythms and repetitions to the unity of the composition as a whole. To forego the planning freedom the flat roof offers would be to turn the clock back and admit defeat, but that modern architecture needs the visual equivalent of the pitched roof there seems little doubt. Here York compensates for its covered ways. The spire-like rooflights (5) indicate the direction in which a successful solution might lie.

The slope problem, then, is the only one for which a satisfactory solution has not yet been sighted. There are other virtues in admired townscapes which are no doubt lacking—the softness of line and surface, the patina of age, visually acceptable decay; but industrialized building is no more defective here than the contemporary non-industrialized alternative and should not be made the scapegoat for these architectural times simply because it is identifiable. Furthermore, in comparison with that alternative it has positive virtues. The greatest of these arises paradoxically from what appears its principal weakness—from the need for a universally accepted dimensional framework. Only the first studies in that direction have yet been made, but already they clearly rest on a marriage (or at least an attempted reconciliation) between technology and human values, starting as they do from a study of the dimensional requirements of human activity far more searching and realistic than the specious aestheticism of the Modular.[5]

The demands of repetition will impose on architects a herculean task of adaptation. As the Building Research Station history shows, tinkering with repetition on too small a scale is to court failure. 'Every genius his own system'—the sort of policy typified by Howell and his partners in Birmingham—is only playing at industrialization. A major reorientation of thinking is needed to redirect architectural effort into channels where, as at the peaks of historical achievement, originality and ingenuity have been tautened and refined within a strict and universal formal discipline. This redirection will quicken and emphasize the trend which is transferring importance from the individual building to the inter-relationship of buildings and the space between them. It is at this point that the dangers of repetition are most threatening and where the defences are least prepared. This is why a Portuguese townscape and not an individual masterpiece forms the text for this present sermon.

It will be evident that this agreeable composition contains examples of all three degrees of

repetition we have defined—the monomorphic and monolithic mass on the left, the quasi-framed and mono-directional row of houses (over shops? or stables?) in the background and the polycuboid mansion dominating as the centre-piece. The diversity of form reflects, of course, a diversity of function, and it is this diversity of function *within a single field of view* which gives the scene its essential quality. Can we not therefore conclude that the more building becomes repetitive the more essential it is to diversify functions within areas small enough to be comprehended. We may conceive of towns as a series of diversified nodes set, perhaps in an undiversified matrix, but closely enough spaced for visual interest to be sustained.

Unfortunately, while diversification is needed for repetition to be tolerable, repetition conspires with administrative tidiness, not only to keep housing, schools, hospitals and roads in separate watertight compartments, but to exclude all the minutiae for which individual and personal enterprise is usually responsible, and which are the binding and humanizing material of the urban fabric. Under what head of authorized public expenditure would modern government pay for the expanses of blank wall which contribute so much by their passiveness to our model townscape? Thus the challenge is not just to architecture but to social and administrative skills. And here a major effort is needed, consciously directed towards environmental integration as its prime objective, an effort in which architectural, social and administrative skills combine. The growing dissatisfaction with local government will not now be long in coming to a head; and when it does so we shall have an opportunity to re-fashion the whole of our environmental administration. The opportunity will not recur; we must be ready to seize it when it comes. A pilot scheme should be started at once. The new universities, with their wide diversity of function, represent a concentrated microcosm of the larger urban scene. With their already unified administration, not too cumbersome and relatively unhampered by precedent, they would form an ideal field laboratory for developing the new social techniques and institutional patterns that will be required. With the use it has made of CLASP, York has already contributed much at the technological level. Let us hope that, with others, it can now pioneer the complementary developments which are no less urgent and if anything more vital.

1. National Building Studies, Special Report 36: *Prefabrication: A History of its Development in Great Britain*. By R. B. White, HMSO, London, 1960. 50s.

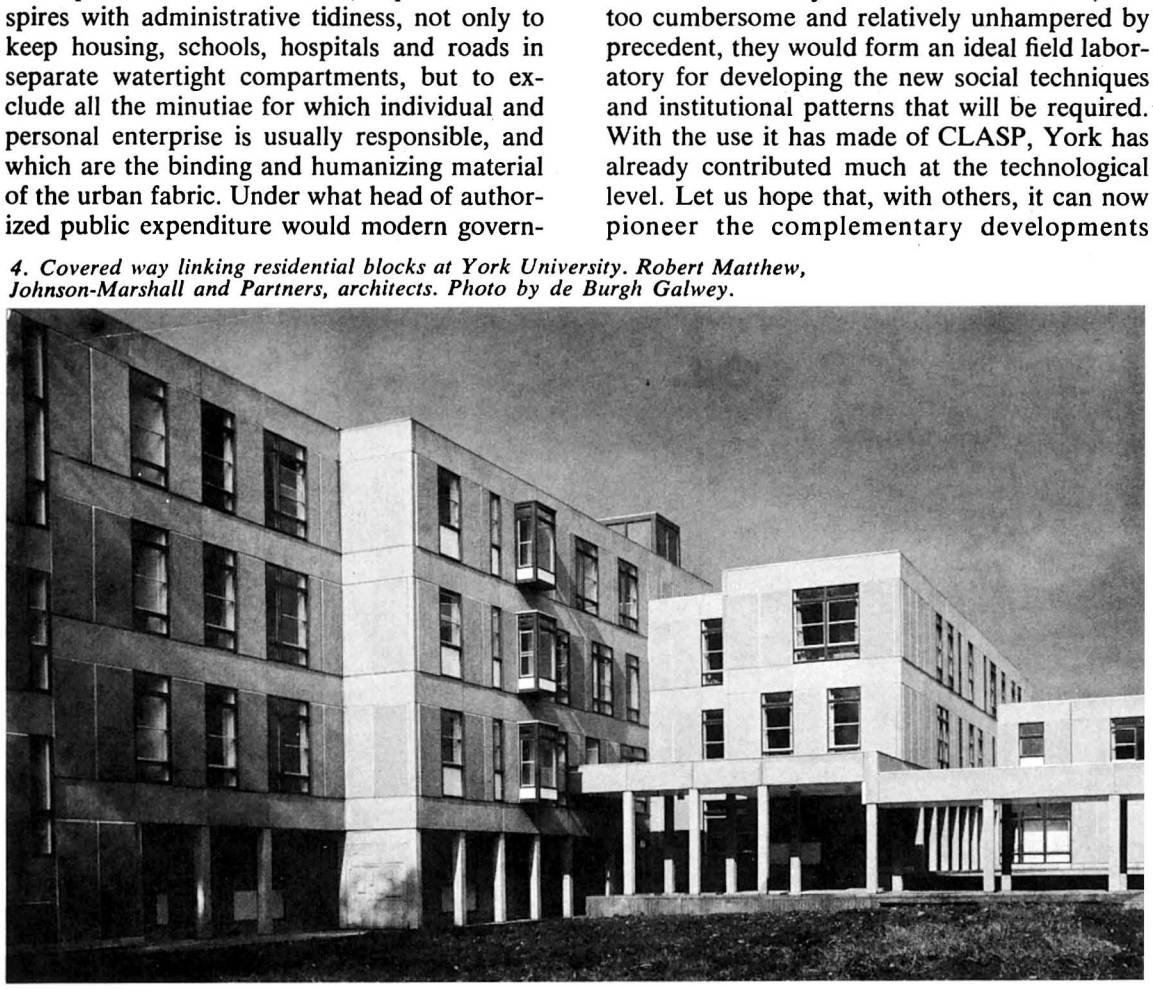
2. *Uniform* in its sense of 'one-formness' is equally valid but too generally used for this context. The Oxford Dictionary defines monomorphic as 'not changing form during development,' which is just what we want it to mean.

3. CLASP designates both the *C*onsortium of *L*ocal *A*uthorities whose *S*pecial *P*rogramme was originally concerned with schools, *and* the system of permanent lightweight prefabrication developed for that programme. The system has been successfully used at the new University of York in the buildings to which reference is made later in this article.

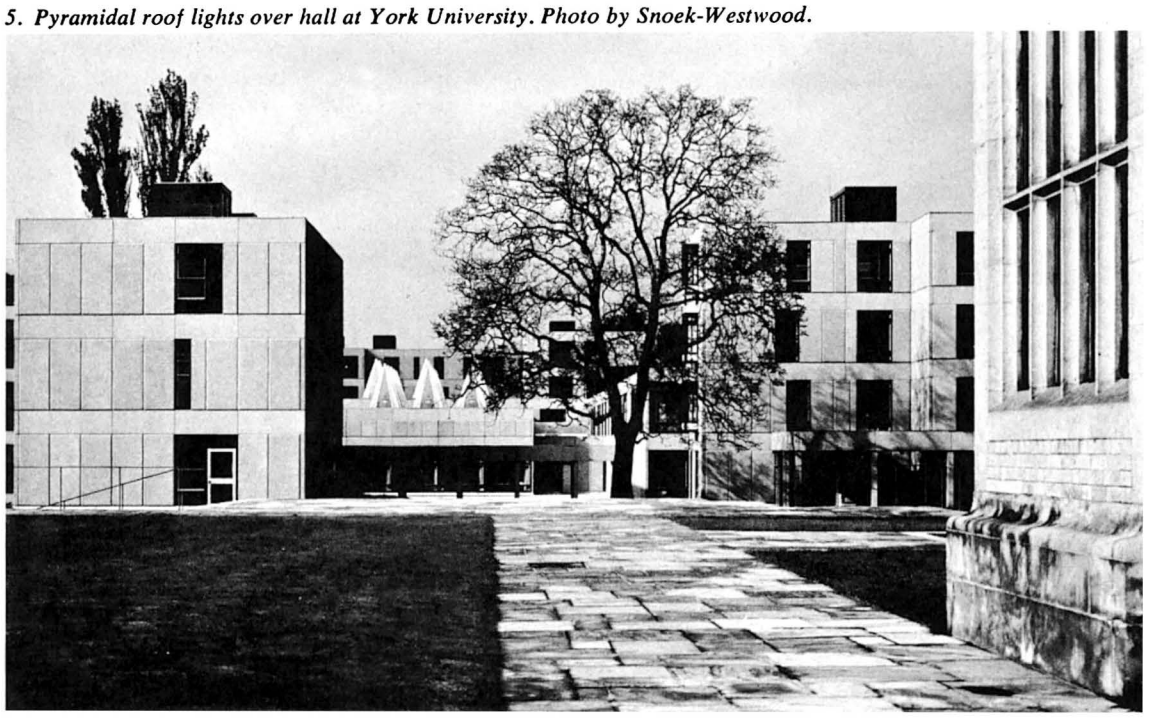
4. Terminology easily becomes confused. Thus, present systems are regarded as closed and consequently unable to accept components not designated for them. If full interchangeability is achieved all systems of prefabrication will disappear and be replaced by one system of dimensional co-ordination. So where designers now lament restricted choice of components they will have unlimited choice of components but will risk lamenting restricted choice of dimensions!

5. The reference here is to the thorough and painstaking anthropometric studies which have been made to determine the leading dimensions for window sills and heads, transom levels and so on. The Modular only replaces Classical distortion of human measures and proportions by twentieth-century distortion; part of the rearguard action against scientific method.

4. Covered way linking residential blocks at York University. Robert Matthew, Johnson-Marshall and Partners, architects. Photo by de Burgh Galwey.



5. Pyramidal roof lights over hall at York University. Photo by Snoek-Westwood.



RESEARCH: THE MOTHER OF INVENTION

KONRAD WACHSMANN

Continued search after truth, to enlighten insight and understanding, to establish facts or principles, is the imaginative process which can only produce meaningful results if removed from any kind of applied activity. To search is man's instinctive urge, explaining his drive to invent, and therefore his society is structured accordingly.

Man's civilization and future are based on his inventions.

Beginning with the first industrial revolution, the history of civilization took a turn in a direction never achieved by man and apparently superior to all other times, through man's capability to control scientifically thoughts and facts, materials and methods, data and causes. Machines followed electrical energy, and the master craftsman, the toolmaker, made industrialization a technical, social and political issue.

The National Science Foundation has said, "The greater the breadth and quality of our basic research and scientific knowledge, the better will this nation be able to lead the rapidly changing international situation and to prosper in the years ahead." Prosperity shall not only be meant in a physical sense but also as a cultural and humane achievement.

The great need for intellectual, scientific, and economic resources is evident, and only universities represent these basic resources. The industrial community, singly and collectively, utilizes the available resources of knowledge. "The more advanced technology of tomorrow will utilize knowledge that springs from the basic research of today. The quality and quantity of tomorrow's manpower for research and development will be determined by today's education and science and engineering."

The question is, Is this society entitled to apply such principles to the art of building? Or is it still necessary to wait for some unpredictable future before man again is permitted to measure his achievements in building on the highest level with the same yardstick of depth with which he looked at the Parthenon or the Cathedral of Chartres? Will the final answer be the collective, impersonal, universal, comprehensive effort, or the individual act of self expression which would make any further research unnecessary?

But with all permissible optimism, if research is necessary, then we have to accept that the creative act of man requires new formulations! Just as much as the doctor prescribes the medicine, and the pharmacist sells it and does not make it himself, so it is inconceivable that the architect, designer and builder can design and build and at the same time engage themselves in research!

In order to establish an appropriate context for the development of research in building, social and economic trends toward such endeavor must be of course considered. The most apparent indicator of these trends has been government, industry, private research organizations, colleges and universities, and other non-profit institutions.

A distinction must be made between basic and applied research since the nature and amount of financing is influenced by this difference. Basic research comprises original investigations for the advancement of knowledge independent of immediate commercial objectives, that is, research for the sake of knowledge in non-profit organizations such as is generally conducted in universities. Applied research, while concerned with inquiry, has limited objectives with respect to products or processes and is bent on achieving commercial goals. It is interesting to note that while industry uses the least basic research and the largest amount of applied research, colleges and universities channel the most substantial amount of funds to basic research.

If basic building research is to find adequate financing, where should it originate? The private architectural office, limited by the lack of long-range or adequate resources and by the profit motive in research, is far from adequate for significant basic research.

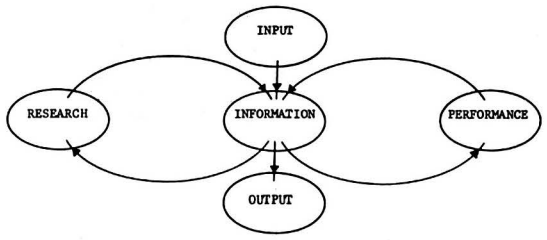
In what "coherent area of science" is the realm of building research founded? Evidently for building research to be accepted among the fields commonly included in government research funding programs, some objective definitive criteria must be established for the inclusion of building research on an equitable level with other fields, especially in the sciences.

The area of building research cannot be categorized so simply, however, since it overlies many fields of science: physics, mathematics, life science, structural, mechanical and social sciences, etc. It may be necessary to supersede some contemporary classifications with combined categories comprising the area of building research to establish the field as a "coherent area of science" acceptable to research funding institutions.

The imprinting of existing technology grows in size and complexity with increasing knowledge. This intellectual capital, reflected in better methods and better products, is more important than the accumulation of physical capital. The body of knowledge in regard to building has increased so much that most of the time spent in studies is absorbed already before proportionately necessary time and energy can be spent in ordering or planning. Knowledge, then can only be the sum of incidental experiences more or less unrelated or out of context.

Some of the investment in basic research which enlarges the body of knowledge at the university level grows increasingly faster than the expenditure for education. Therefore, it must be the challenge of the universities to restructure the method of learning.

It is obvious that no single man can do this. It is less obvious but equally true that a group of professional people cannot do this. The daily production, for instance, of the early farmer was needed to replenish his exhausted energies. Only from the day on which a certain surplus is built up can the growth of a civilization start. Only on the day society, in full recognition of all facts, is willing to equip and feed scientists can building science and building research start to grow (see diagram).

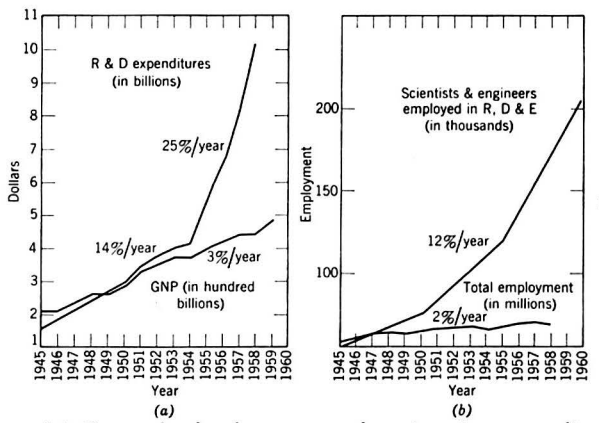


This diagram separates clearly the three areas of human endeavor: research, information, performance. It is self-explanatory and may be the basis for better understanding of the structure of a continuous process for the exchange between building research and performance, resulting in planning and design in their meaning, more fitting to the aims, challenges and purposes of the contemporary civilization.

How much all this has to do with the art of building is obvious. Art should be only based on knowledge, on the highest level of scientific or technical performance.

A new framework of man's thought, study, search and analytical investigation of the meaning of building should be structured within a college or university, which then may not be the same anymore in the traditional sense. A new order may prevail; an inter-disciplinary system without the barriers of faculty specialization, exploding in universal, international and comprehensive planned research. Such continuous search after truth may take place, leading to the answer of the eternal question WHY? in an educational organism which every university should have: an institution of building research.

Written in collaboration with John Bollinger and Peter Rodemeier. Graphs below by the National Science Foundation.



(a) Research, development, and engineering expenditures. (b) Growth of employment in research, development, and engineering.

Basic Research, 1957-58—Intersectoral Transfers of Funds Used for Performance (in millions).

SECTORS: Funds Provided By / Funds for Performance of Basic Research By	FEDERAL GOVERNMENT	INDUSTRY	COLLEGES AND UNIVERSITIES	OTHER NONPROFIT INSTITUTIONS	TOTAL	PERCENT DISTRIBUTION, BASIC RESEARCH SOURCES
FEDERAL GOVERNMENT	$111	$42	$240	$30	$423	51
INDUSTRY		$230	$14	$5	$249	30
COLLEGES AND UNIVERSITIES			$111		$111	13
OTHER NONPROFIT INSTITUTIONS			$27	$25	$52	6
TOTAL	$111	$272	$392	$60	$835	100
PERCENT DISTRIBUTION, BASIC RESEARCH PERFORMANCE	13	33	47	7	100	

music

PETER YATES

A Column of Books

Mojo Hand by Jane Phillips (Trident Press, New York, 1966; $4.95)

"I'm going to Louisiana and get me a mojo hand. I'm going to show all you womens just how to fix your man."

Religious, cultural, social, or ethnic differences can get on for centuries side by side with some irritation along the seams but no radical tear: faiths insulated by mutual incomprehension; cultures having each a separate idiom; the slave, servant, or peasant proud in allegiance to the master house; each of these brought to an extreme by differences of race and color. But when the enclaves break up: "You can have no idea what it is like to be a Negro; you'll never know, never be able to know what that is like," an educated fellow worker once turned against me in a voice scream-edged with unappeasable bitterness. Like an unwise liberal I had let my words sound pity in sympathetic difference.

Poverty and unemployment exacerbate the brutal consequences of ignorance and superstition where divided societies mingle at the edges but refuse to join. The nomadic invaders of modern society do not enter by warfare but by expulsion: by exportation as slaves, by flight as refugees, by economic distribution as unemployed or surplus population.

Between the distinctive social cultures of the American South and North and among its unprecedented diversity of religious, cultural, and ethnic enclaves a nomadic movement has replaced the former drive towards and beyond the no longer moving Western frontier. For all the diversity and increase of these intercultural and intracultural minglings, the literature of mutual comprehension among them is still less than the literature descriptive of their differences. In America discussion of the "blues," the most authentic folksong of the American Negro, continues to be esthetic and descriptive; we speak of the "blues" as works of art and no more than incidentally as outpourings of an agony of mind.

Do I mean spirit? Spirit, too. But we think of the spirit as spiritual, religious, therefore self-sufficing and in some sort consolation. We do not grasp the agony of frustrated intelligence, debased wisdom, elemental social superstition and moral exile—agony of mind. What can you do when you can't have no wisdom! Some of that agony has come to us of late in a literature of professed hatred and as interpretation of certain extremes in Negro jazz, through the voices of exiles, unrooted in the cities. For them the "blues" are an esthetic manifestation of trouble. They have escaped the inert region where the "blues" have origin, where "trouble" isn't the unrest of being different, it is the emptying passion of being what one is.

My young frind, Jane Phillips, daughter of a fellow civil service employee, student at Immaculate Heart College in Los Angeles, heard the call of this deep region in the sound of a recorded voice and a guitar and went to look for her own people. Brought up protected, nearly white and able to "pass," she went to her crisis with the desperate emotional courage of adolescence. She had heard me play for a lecture a record of Leadbelly singing. The next summer she traveled with a group to Raleigh, North Carolina, where they tried to "liberate" a Howard Johnson motel and were jailed for trespass. She told me her story with a little laugh and no boasting. From her cell directly over the women's drunk tank she heard the voices shouting, cursing, crying the blues. When she returned she had written her own Leadbelly songs. She learned to accompany herself on the guitar and in December sang two of her jail songs for my Christmas broadcast. Then I learned she had gone to Houston looking for a folksinger named Lightning. He thought her white and wouldn't let her in, but when she had convinced him he let her on the platform to play with him. From time to time I heard from her, a phone call in Los Angeles, a call in Frisco. She came over once for an evening and told us she had found her own people and had to go back.

After a long break she surfaced in a golden rumor. And it was true. She had sold her first book for a generous advance: she took it to the head of the English department where she had gone to school; a novelist himself, he sent it to his agent. Jane Phillips was an authoress with her own money and a car.

The success story of a first novel is a not uncommon tale, but *Mojo Hand* is an uncommon book, written out of an agony so true one cannot be embarrassed. The talk is truly heard, the filth of an idiom which knows no other language, poetry of an inert region of the mind, offering nothing to the scabrous. The sex is brutal confined in boredom, no relief or escape, and no erotic appeal.

" 'Girl, you got some strange things turning 'round in that head of yours. Why *did* you come here anyway?'

" 'I don't know. I just felt like it.' . . . It was useless to try and find the causes of her being here; she merely was and could never be sure whether it was a true act or a posture of defiance. . . . To her the excesses of the heart had to be able to run rampant and find their own boundaries, exhausting themselves in plaguing hope.

"Blacksnake looked at her. 'What you thinking 'bout now, girl?'

" 'Oh, nothing much.' " No *Candy* here. Not much explaining either. From the beginning, a little dubious through the first chapter but never again in doubt, we know that we are where she is, in the jail and unpaved slum black alleys of Raleigh, North Carolina, among people morally deprived and bound to sex and liquor by inert imagination. And voices singing beyond misery in the language of the "blues."

"Girl, you crazy to like it down here."

The seams of observation and of fiction are so tight sewn, it's hard to believe the story is not all her own. I'd better not let any pity out of my mouth. A self-discipline that will permit no false sentiment controls the paragraphs and directs the sentences: ". . . she gritted her teeth, ground them, cursed, and called to God at the same time, but still she was completely herself. When he had finally fallen asleep, she disengaged herself from him and slipped out of the bed. Quietly she put her clothes on and went out in the early morning."

A pale stranger in a region of filth and habit utterly unlike her own, she concedes herself nothing, senses continually alive to men and women who move and speak around her in their own dimensions. The dialect of the speech is in the order and rhythm of the words. "The music gathered momentum and people were calling, 'Play that, play that, daddy!' Blacksnake doubled over the guitar, and every note ripped the air to shreds. *"Yes, I bought that woman, I bought her a new pair of shoes, and she did not buy me nothing but the blues, but I just got to find my baby."*

"Eunice picked up the guitar and stared at it. . . . Suddenly it came out and she could not stop it; her fingers moved and her voice cried against her will, giving birth to the song. *'Mmmm, blacksnake crawling 'round my room, mmmm, blacksnake crawling 'round my room, won't some sweet daddy come and get this blacksnake soon.'* And it flew on. *"Mmmm, it must have been a bedbug, 'cause a chinch couldn't bit me so hard . . . but somebody told me it was a blacksnake came in from the front yard.' "*

The women in the jail, the men in the restaurant, poolroom, funkhouse, the shabby bedroom dialogue, everything said tailing off into the "blues." "Goddamn it, *go* then! You never find a home as good as this. I'm got to say, bye-bye, baby, be on your way. Just don't come crying to the Blacksnake some old rainy day."

Not fiction: narrative, but the seams hold. And strangely, not dreary, none of the symbolic misery of *The Lower Depths*. No salvation in sight. None of the prurient "honesty" of the "better fiction" and the movie trailers to stir you. Nothing generalized, it is all particulars. This murky region rejects hope and civil rights; here Negro social leadership has not penetrated. The white man is not a human enemy but a creature of another species. These

country-born drifters hang on the fringes of work and destitution, their anger undirected, cut off from the purposive smouldering of the urban ghettos. They are the inhabitants of Southern jails, Leadbelly's people, their only inheritance the "blues."

Eunice doesn't come home again. She turns up at the door of Blacksnake's near blind old mother to stay and have her baby, and the book ends. "Sweet mama, you looks so lonesome and cold, your man done left you carring a new load."

But first there is the long episode and build-up of men and women in South Bay, around Mary Millson's Artificial Flower Shop. And the death of Blacksnake at the hands of his old Sally Mae, because of a "mojo," rattlesnake rattles and a "bone." "When I left my home this morning, you know, I left my little baby crying, she say yonder go, yonder go that loving man of mine." In this region of ignorance and fouled hope the passion of living, obscured and avoided in politer places, pulls very close.

Gilbert Chase: *America's Music: from the Pilgrims to the Present* (revised second edition, McGraw-Hill, 1966, $9.95) and *The American Composer Speaks,* a historical anthology, 1770-1965, edited by Gilbert Chase (Louisiana State University Press, 1967)

The second edition of Gilbert Chase's 12-year-old classic, *America's Music,* is a magnificent tome, 695 pages of revised text, 31 pages of bibliography, and 32 pages of index, packed with valuable information, though heavy in the hand. The back dustcover quotes from the newly added chapter, "The scene in the sixties," a passage which includes the names of Cage, Partch, the ONCE group, and a reduced page of notated, diagrammatic, descriptive score from Roger Reynolds's setting for soloists, chorus, instruments, choreography, costumes, and lighting of Wallace Stevens's poem, *The Emperor of Ice Cream.* Chase writes in his introduction: "I never try to admire what it is merely respectable to admire."

Chase believes that American "folk-popular music . . . has been the most important phase of America's music." And if you ask what he means by important, he will answer "different from European music." The real, ripe, glorious beauty of this book soars above a ground of American folk idiom from the first mention of William Billings (1746-1800) into the early discoveries of jazz. Then trouble starts, because Chase has not solved better than any of the other jazz enthusiasts the problem of writing a documented history of jazz. This is not to deprecate his accomplishment; he has done as well as anyone. The problem is in the documentation, what I call the "baseball statistics" of jazz: the paragraphs of names, dates, places, bands, compositions, and changes of style which encumber the subject. Here and in the chapters about eclectic and conventional composers the flow of his writing is bogged down in a bayou of facts. Let's agree that the facts are necessary, but why not relegate many worthy names and honorable compositions to a group of appendices, getting these out of the reader's way, as he has disposed of all but a minimum of footnotes.

Taken as a whole *America's Music* is a pleasure to read, and it has no competitors. By careful editing the author has been able to insert some names and material omitted or less well documented in the first edition. Chief impediment to the second edition has been the publisher's requirement that he confine his changes as much within the original text and page format as possible; there was also a limitation of book length. To provide for the additional 33-page chapter on the 1960s he had to choose between eliminating his chapter on MacDowell or his chapter on Indian music. MacDowell was "historical" and Indian music, however important, peripheral to the central subject; the Indian music went. I would guess that a still more serious loss is the quantity of detail with which the author would have filled out many other topics, if unrestricted by the space and page limitations.

Scholarship in American music has come a long way since John Tasker Howard wrote *Our American Music* in 1931, and it traveled a still faster pace between then and 1955 when the first edition of *America's Music* appeared. Until 1915, when Arthur Farwell and W. D. Derby published *Music in America,* American folk music was either unrecognized or confined to Stephen Foster and exotic references to American Indian and Negro music. At that time it would have seemed incredible that an American composer could be writing music large as that of Beethoven and concentrated as a madrigal, replete with the common tunes of American churches and city streets, in a style growing out of the non-European idiom and rhythms of American folk-art, as Charles Ives had been doing for more than twenty years. Even today, among many musicians and critics, the offense against good taste remains. For 150 years American folk music had gone its way as lively as the native weeds, while persons of good taste tried to put it down or ignore it. Driven from respectable surroundings it flourished and mutated below the level of notice, in hymns, anthems, folksong, secular entertainment, the minstrel show, ragtime, until it reappeared in a flood of cheap dance records heard and sold in dime stores—these records are now collectors' items. Jazz, the personal idiom of a few players and singers in improvisatory collaboration, was domesticated and adulterated to popular taste as dance music and only after that respectably discovered, written about, documented and appreciated.

But what had been put down by genteel musicians in the singing of hymns and anthems, where for a century the folk idiom most fervently persisted, was not the bad but the good, a tradition of free part singing, with elaborate alteration and embellishment of notes and rhythms, which reaches back to the great art of 16th, 17th, and early 18th century song. The skill had been vulgarized, and the tradition of "Good Taste" which authorized it had come down to a noisy freedom which seemed to literal-minded, well-educated musicians the epitome of bad taste. This noisiness, at the worst, this wonderful freedom and musical purity, at the best, are the true source of American indigenous musicianship, of ragtime and jazz, and of the composers whom we are now beginning to recognize as the creators of genius in our native music.

That recognition is not yet so widespread as it soon will be; the music of American genius is only beginning to be known and heard. Among conservative musicians and critics praise of American music is still "chauvinism." Two weeks before writing this I sat through a recording session while Gregg Smith directed a performance of compositions for solo voice and instruments by Ives, songs known until then only in the composer's later arrangements for voice and piano. These songs in their original instrumentation, assembled by Gregg Smith and John Kirkpatrick from the Ives manuscripts at Yale, may influence the music and listening of the next decade as decisively as the Webern songs for solo voice and instruments have influenced the world's music since they were recorded here in Los Angeles slightly more than a decade ago. Columbia records, which issued the *Complete Webern,* is actively preparing the several albums of a complete Ives.

And while the discovery of American music to which he has made great contribution continues, Gilbert Chase is already laying the groundwork for a definitive third edition, "the most important work I have to do on this earth." I would have it for my own taste in two volumes, each a more comfortable in the hand 400 or 500 pages—not a monument of scholarship but a foundation for the ongoing work of our native continental music. The real worth of musical history consists not in documentation and recovery of what happened in the past but in stating and assembling this material as guide, warning, and inspiration to musicians seeking the future direction of their art. No other work of scholarship contains more of importance for American musicians than *America's Music.*

This is one of three books lately issued which deal with 20th century music. William Austin's *Music in the 20th Century from Debussy through Stravinsky,* the sixth volume of the Norton History of Music, is a compendious but conservative summary, stopping short of the more radical developments in recent years. My own *Twentieth Century Music, Its Evolution from the End of the Harmonic Era into the Present Era of Sound* directs attention to the great evolutionary change in music during the last 100 years

and to those composers who have most influenced the successions of mutations in our esthetic experience of sound from Wagner and Liszt until the present day. The last third of the book concerns almost entirely the work of American composers. Gilbert Chase, discussing for the most part only American origins, demonstrates how these have effected a contemporary American music independent of European reference. This is not yet the larger part of American music, in comparison with the conventional and the commercial, but it is the most vital, and what is happening today in creative musicianship, worldwide, to a great extent proceeds from it.

Where Austin is analytical and I am argumentative, Chase is documentary; he gives names, dates, facts, quotations, and chronology, relying on exposition to do the work of explanation. If his coverage of American composers in these last decades is far from complete, the cause is beyond criticism: never in history has such a multitude of composers in one nation been composing so much music. No historian can do more than sample among them. But I would again propose that in assembling his definitive third edition, for which we may have to wait perhaps another decade, he enlarge the listing of composers and their works by appendices referred to from the text. Indeed such a listing might be so large that it would require a supplementary volume. The growth of activity in the arts, though still concealed by public indifference, is on such a vast scale that its potential for our culture during the next decades staggers the imagination.

I shall mention finally, with admiration, the equal attention and care Chase has devoted to the arts and composers of popular commercial and stage music. He does not try to delude his readers into believing that popular music is either entirely distinct from or the esthetic equal of true art music or true jazz, but he gives full value to the principal craftsmen in the field, to the forms in which they work, and to those outstanding works in which popular music has a more commanding significance. And he is not bemused to believe that complexity, correctness, form, or educated style confer on pretentious imitation, however sincere, the authority of enduring music. "My own approach to America's music is not at all respectable," he tells us, "—my bete noir is the genteel tradition, and I take my stand with that Connecticut Yankee, Charles Ives, whose most damning adjective was said to be 'nice'." Nonetheless he is more than scholarly fair to Lowell Mason, who became to his own great profit through his publications the central figure of the 19th century genteel tradition and the founder of American musical commercialism.

The American Composer Speaks records the unceasing dun atmosphere of public and critical hostility in which American composers for two centuries have been laboring to create a native continental music. It is a historical record Chase could edit but not alter. Thirty American composers, from Billings to Earle Brown, are represented by complete or abridged essays on the art of music as understood it very badly. Only Ives, among the more modern writers, returns to the full-throated diapason of one-eyed, crook-gaited William Billings, writing to a critic: "You syllable snatcher, if you are but half so honest as I am condescending, you will acknowledge I have made game out of your own hand, and beat you at your own weapons! You comma hunter . . ."—joyously finishing him off with a stanza.

Chase drew inspiration for his book from Henry Cowell's *American Composers on American Music* (published 1937, reissued 1961), but Cowell's book is all of one period. Chase's historically valuable collection includes the varying opinions of successive periods, the unending border warfare between composer and critic, artist and public, conservative against encroaching barbarism. "There was what we may call Russian barbarism, which came to us from Moussorgsky and Rimsky-Korsakoff, via Prokofieff and Stravinsky," Daniel Gregory Mason, grandson of Lowell Mason, could write as recently as 1928. In 1954, Arthur Berger, earlier named by Aaron Copland as one of six members of an American "Stravinsky school," himself confers membership in that school on a batch of newer composers. In 1939, Edgard Varese was writing, very belatedly to his practice of the 1920s, "Personally for my conceptions, I need . . . a sound-producing machine (not a sound-reproducing one)."

While conservative composers are still striving to define and limit musical expectations, even while searching for a newer music, one hears the rising challenge of the new era of sound. Edward MacDowell, describing "the long, trembling tone-tint of a bronze gong," shows in his language the sensuous responsiveness to sound which his musical decorum rejected. Ives, refusing to be musically confined by any sound which interfered with "substance," pushed out the boundaries to extremes not yet conquered by electronic means. In 1957, belatedly to his great manifesto of 1937 and his subsequent practice, John Cage declares, ". . . in this new music nothing takes place but sound." In 1960, Roger Sessions questions "the sufficiency of the post-Webernian trend as a firm and comprehensive basis for new departures in music," disregarding the multitude of other new departures which have occurred during his lifetime. In 1963, Earle Brown summarizes ten years of "concepts and principles" in his composing: "No two performances will arrive at the same formal result, but the work will retain its identity . . . through the unchanging basic character of the events."

One can sympathize with that earlier genius by personal fiat, A. P. Heinrich: "I shall forthwith return very independent, nay stoically to my lofty garret in New York . . . and most likely upset the Musical consumation (sic) of American Liberty (Vide my Prospectus) . . ." Many prospectuses have been upset but not the liberty, too often unrewarded, of American music.

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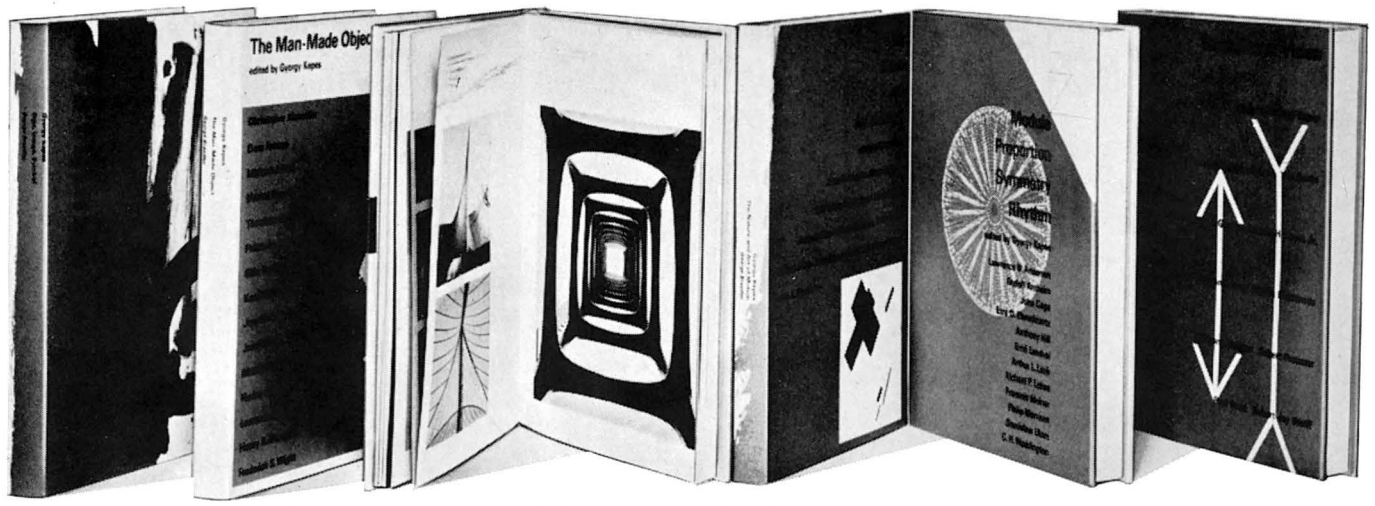

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